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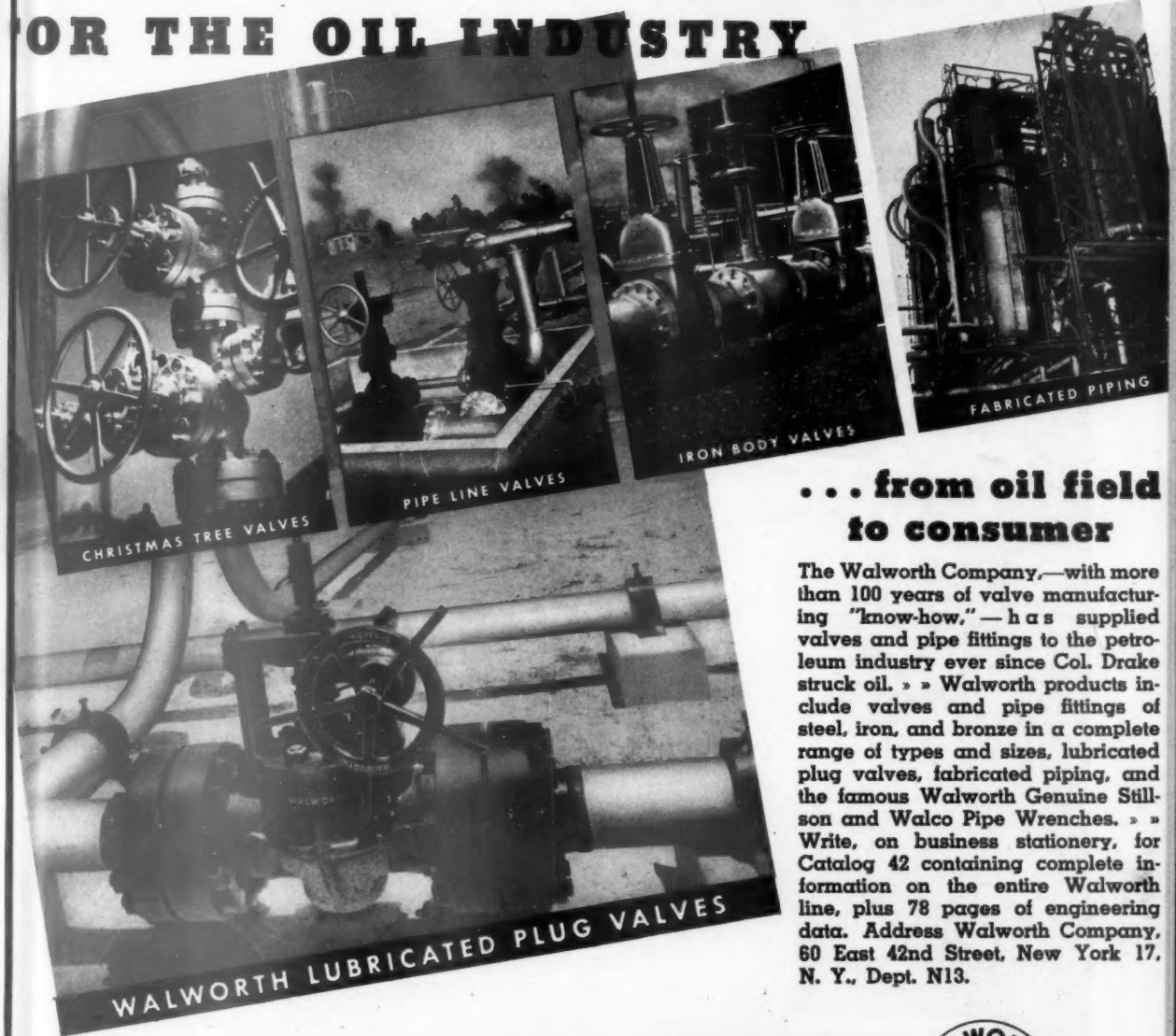

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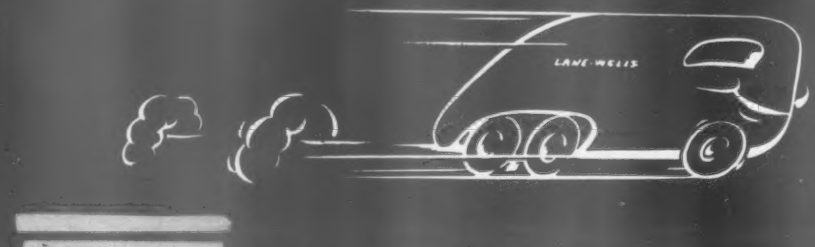

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Trends

Crude-Oil Production
By States—Page 118

CRUDE-OIL STOCKS 222,467,000 bbl. as of November 11—down 427,000 bbl. One year ago 238,404,000 bbl.

GASOLINE STOCKS 78,091,000 bbl. as of November 11—down 318,000 bbl. One year ago 68,344,000 bbl.

RESIDUAL FUEL-OIL STOCKS 63,999,000 bbl. as of November 11—up 555,000 bbl. One year ago 62,409,000 bbl.

GAS OIL AND DISTILLATE STOCKS 48,259,000 bbl. as of November 11—down 218,000 bbl. One year ago 45,296,000 bbl.

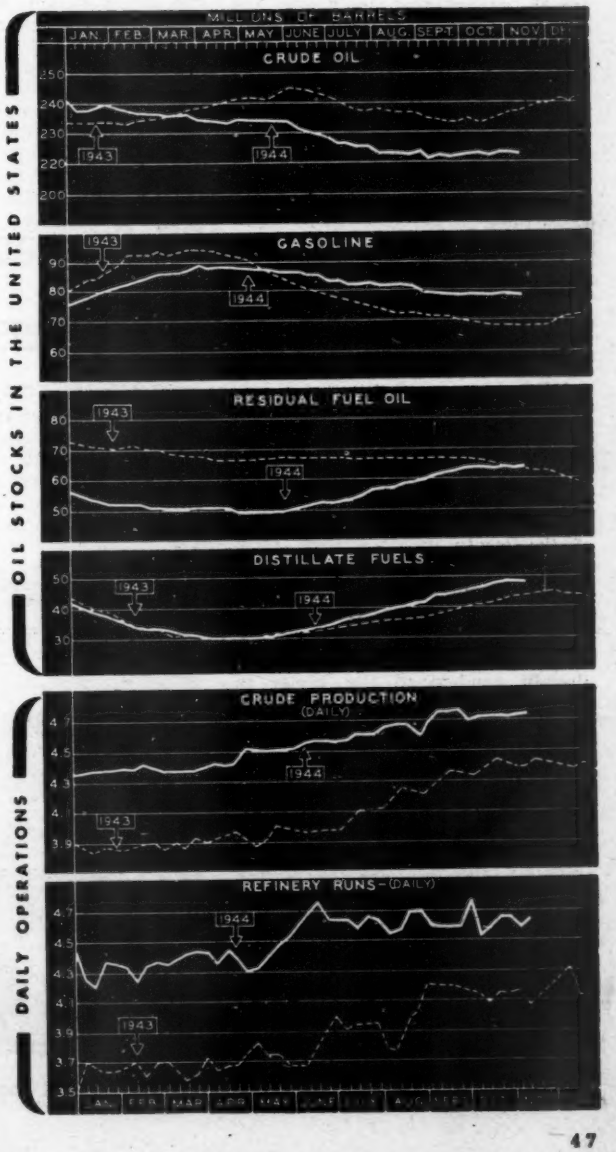
CRUDE-OIL PRODUCTION 4,736,300 bbl. as of November 18—up 4,450 bbl. One year ago 4,414,060 bbl.

REFINERY RUNS 4,650,000 bbl. daily week ended November 11—up 80,000 bbl. Year ago 4,154,000 bbl.

THE statement of Secretary of Commerce Jesse H. Jones (The Oil and Gas Journal, November 18 issue, page 185) that the 24-in. and 20-in. War Emergency lines should be able to operate in competition with tankers in the postwar period has renewed the discussion as to what disposition should be made of these lines after peace comes. It was considered significant that the statement of Jones, who is head of the governmental units which own and operate the two lines, announced his intention to sell the mammoth transportation arteries to private owners.

CURRENT comment and earlier analyses reveal substantial disagreement among transportation authorities as to the permanent economic position of the two lines, which have sufficient capacity to transport approximately 550,000 bbl. daily of crude oil and products between Texas and the Atlantic seabord. It is contended that the Jones analysis, covering comparative costs, is not based on conditions that will prevail in the postwar period. The major cost items in the case of crude oil have to do with the gathering charges in making available 300,000 bbl. or more crude oil at the East Texas terminal. It is felt that when war controls cease it will be impossible to make available that much crude, which is necessary for low-cost operation. It is also maintained that if the two lines are to be operated at capacity in the postwar period, there must be additional connecting lines to deliver the crude oil and products to more refineries and terminals. These distribution lines would add materially to the over-all cost of operating the systems.

THE proponents of tankers point out that water transportation has this required flexibility in distribution in that deliveries can be made directly to a large number of existing terminals and refineries along the East Coast. They also object to the war-controlled rates used in making the comparison with pipe-line costs. While is is not expected that tanker rates will drop to the low levels of prewar days in Gulf Coast-East Coast shipments, data are offered showing that modern tankers can be operated in coastwise movements 50 per cent under the rates now in effect. Economists with these conditions in mind are urging an industry investigation.



Administration Expected to Ask For Early Action on Oil Pact

by Henry D. Ralph

WASHINGTON. — Indications that the administration intends to press for prompt action on the Anglo-American petroleum agreement are seen in the announcement of Chairman Tom Connally that the Senate committee on foreign relations will take it up early in the next Congress, probably immediately after hearings on the Mexican water rights treaty.

The administration had expressed willingness to postpone ratification action until the oil industry had had ample opportunity to study the agreement and shape its views. Apparently the belief now is that sufficient time has been given and the treaty should be brought up in the Senate.

This will not necessarily prevent further consultation with the British with the view of modifying certain language in the event the State Department considers this expedient, but in effect it serves notice on the Petroleum Industry War Council to hurry up with its concrete suggestions for specific changes in language.

The next meeting of PIWC will be held December 6, at which time its national oil policy committee is to bring in a report recommending definite constructive changes in the text of the treaty. Should the council postpone action, it is possible that the State Department will ask the Senate to begin consideration of the treaty in its present form without waiting for further suggestions from the industry.

Many Groups Assail Treaty

Many oil industry groups have already condemned the treaty in strong language, and opposition undoubtedly will be presented at hearings before the foreign relations committee and the special Senate petroleum resources committee, which probably will hold joint hearings with the foreign relations group. However, the State Department takes the position that hostile criticisms for the most part have not been specific and based on misinterpretations of the language and intent of the agreement.

Administration officials who participated in the negotiations and drafting could easily counter such opposition by testifying that the treaty would not be applied as its opponents fear. Such testimony should carry at least as much weight as general opposition from oil men, unless the industry comes forward with specific proposals for changes which would insure application of the treaty in the way that the administration says is intended.

It is known that individual members of the Senate have been impressed by the opposition that has developed. They have received copies of denunciatory resolutions adopted by Independent Petroleum Association of America, Western Petroleum Refiners Association, Gulf Coast Refiners Association and other organizations and groups representing the oil industry. The opposition has emanated not only from the production and refining divisions, but also from groups representing the marketing division. Jobbers and dealers are closer to consumers than are the other petroleum organizations.

There is evidence that the oil business has been successful in its efforts to show that the issues involved in the Anglo-American agreement go deeper than the allocation of petroleum supplies and demands between the two principal oil-producing nations. In the recent analyses made by George A. Hill, Jr., president of Houston Oil Co., and J. Howard Pew, president of Sun Oil Co., it was emphasized that broad matters of public policy are inherent in the proposed petroleum treaty which if approved would establish precedents in all foreign trade relationships. Some senators representing consumer states might quickly approve a treaty involving petroleum but would be slow in establishing a treaty-making precedent which could later involve agriculture and any of the major industries in which their constituents are directly interested. For this reason it is predicted that business enterprises outside the oil industry may become interested in the forthcoming Senate committee hearings with the result that consideration of the oil treaty will broaden into an "open forum" on foreign trade policies.

Oil Compact to Meet in Jackson, Miss.; Foster Assumes Secretaryship

OKLAHOMA CITY. — The winter quarterly meeting of Interstate Oil Compact Commission will be held December 15 and 16 in Jackson, Miss., its first official appearance in that state. Also it will be the first meeting of the commission to be conducted by its new secretary, Earl Foster, of this city, who will assume the secretarial reins December 1.

EARL FOSTER

The executive committee, headed by Gov. Andrew F. Schoeppel, Kansas, chairman of the commission, met here last week, accepted the invitation of Mississippi's Gov. Thomas L. Bailey to hold its next meeting in Jackson, and filled the secretarial vacancy existing since the resignation of Charles L. Orr last July by appointing Foster, who is conservation attorney for Oklahoma Corporation Commission

Committee Will Report

The committee appointed Ted Knoop, former assistant secretary, to serve as secretary of its interstate relations committee. That committee, E. G. Dahlgren, acting secretary of the commission, said, will report on its current project, the preparation of a simplified text on oil and gas conservation, at the Jackson meeting. Dahlgren retains his position as assistant secretary of the commission and also as full-time secretary of the research and coordinating committee.

Earl Foster was born on a farm

near Marion, Kans., and was educated in Oklahoma. He received his B.A. degree from University of Oklahoma in 1912 and his LL.B. in 1913. Upon graduation, he went to Drumright, Okla., where he soon became city attorney. In 1916 he was elected county attorney. Nine months after his reelection he resigned to enter private practice. In 1927 he was appointed to the State Supreme Court Commission and moved to Oklahoma City. He resigned in 1930 to reenter private practice. In 1935 he was appointed attorney for the oil and gas conservation department of Oklahoma Corporation Commission. He has been chairman of the legal committee of the Compact Commission since 1938.

A son, Earl, Jr., graduated from the University of Oklahoma and was a junior law student when he entered the Air Corps, in which he is now a captain. He has been active in Rotary Club work, having served as president of the Oklahoma City club, district governor of Rotary, and chairman of the constitution and bylaws committee of International Rotary.

Bay Petroleum Acquires Control of Chalmette

NEW ORLEANS.—Bay Petroleum Corp. of Denver has acquired control of Chalmette Petroleum Corp., New Orleans, for a consideration in excess of $1,000,000. Chalmette, occupying a site of 55 acres, with a tank farm of 750,000-bbl. capacity, operates a 9,000-bbl, refinery near this city, with a barge loading terminal on the Mississippi River. It has tank-car and truck-loading facilities. Operations will be continued under the name of Chalmette Petroleum Corp.

Bay, which operates refineries at McPherson, Kans., and Denver, is headed by C. U. Bay, of New York. It has oil production operations in Illinois, Texas, Kansas, New Mexico and expects to open production offices in Northern Louisiana or Mississippi.

The new officers of Chalmette are: Charles Bay, chairman of the board; Roland V. Rodman, president; C. O. Garbrecht, vice president; Dent N. Hand, secretary and treasurer; Leo L. Leabo, director of sales; L. E. Vivien, general manager.

Phillips Posts Price in Three Kansas Fields

BARTLESVILLE.—Phillips Petroleum Co. has posted $1.01 a barrel as its price for crude oil purchased in the Dopita, Morel and Penny-Wann pools of Kansas. The posting is effective as of November 1.

Production Rate for December Raised 2,500 Bbl. by PAW

WASHINGTON. — A production rate of 5,026,400 bbl. daily of all petroleum liquids has been certified to the various oil-producing states for December by Petroleum Administration for War. This is an increase of 2,500 bbl. over the November certification, but about 25,000 bbl. below the all-time high of 5,051,300 bbl. certified for September 1944.

The rate for the East Coast states (District 1) is decreased slightly from that of November to conform with indicated actual productive capacity, Acting Administrator Ralph K. Davies said. In the midwestern states (District 2) the December rate is a net increase of 5,000 bbl. This increase is attributable to Oklahoma and Kentucky, where completions in recently discovered fields has raised productive capacity enough to offset the decline in production of older fields.

Production rates for the Rocky Mountain states, California, and southwestern states are at substantially the same levels as those certified for November.

Commenting on the rate certified for Texas, Davies said: "Although the total quantity of crude oil certified for December in Texas has not been changed, it will be necessary that some fields continue to produce in excess of their maximum efficient rates in order to supply programmed requirements for refinery runs within the southwest district and for necessary movement of crude oil into other areas. Moreover, difficulty has been experienced in obtaining sufficient sweet crude oil to operate the War Emergency Pipeline at capacity. Therefore, it would be desirable to redistribute allowables among the sweet crude fields so that sufficient production from those fields tributary to the Longview terminal of the War Emergency Pipeline would be available to fill adequately the requirements of the line."

Following are the daily rates of production certified for each state for December as compared with the rates certified for November and the actual production for December 1943:

PRODUCTION RATES IN BARRELS PER CALENDAR DAY

	December 1944		November 1944 certified total petroleum liquids	December 1943 actual production petroleum liquids
	Certified total petroleum liquids	Estimated natural gasoline and condensate		
District 1:				
New York	13,000	.....	13,500	13,200
Pennsylvania	41,400	1,400	42,300	40,600
West Virginia	15,200	6,800	14,900	15,300
Total	69,600	8,200	70,700	69,100
District 2:				
Illinois	212,300	12,300	212,200	231,700
Indiana	13,000	.....	13,000	13,400
Kansas	280,000	6,000	280,000	273,300
Kentucky	32,800	2,800	28,800	24,500
Michigan	47,500	500	51,000	53,300
Nebraska	1,200	.....	1,000	1,000
Ohio	8,600	600	9,500	9,600
Oklahoma	337,000	27,000	371,900	357,200
Total	972,400	49,200	967,400	964,000
District 3:				
Arkansas	83,100	5,100	83,100	82,400
Louisiana	385,300	35,300	385,000	369,500
Mississippi	53,000	.....	50,000	44,900
New Mexico	111,600	5,600	115,500	116,100
Texas	2,278,000	145,000	2,278,000	2,007,700
Total	2,911,000	177,000	2,911,600	2,620,600
District 4:				
Colorado	9,500	.....	9,000	6,800
Montana	23,400	400	24,400	23,900
Wyoming	103,500	3,500	103,400	88,200
Total	136,400	3,900	136,800	118,900
District 5:				
California	937,000	52,000	937,400	838,400
Other	.....	.....	.....	100
Total United States	5,026,400	304,300	5,023,900	4,611,100

Sinclair Promotions Make Clark Head of Executive Committee

NEW YORK.—Sheldon Clark, who entered the Sinclair organization in 1916, was named chairman of the executive committee of Sinclair Oil Corp. last week to succeed the late E. W. Sinclair. Albert E. Watts, associated with H. F. Sinclair more than 30 years, was elected vice president. He and Leland V. Stanford, for many years a Sinclair official, were made directors. George H. Taber, Jr., with Sinclair since 1919, was chosen president of Sinclair Refining Co.

R. J. Black was made assistant refinery manager. He will continue in East Chicago, but will have supervision over the East Chicago, Kansas City, Coffeyville and Sand Springs plants. R. G. Arner was appointed superintendent of the East Chicago refinery, and W. V. Ischie assistant superintendent.

Clark for several years has been vice president and director of Sinclair Oil Corp. and vice president of Sinclair Refining Co. with headquarters in Chicago. He is one of the four advisory governors of the Chicago Stock Exchange, director of First National Bank, East Chicago, Ind., and a director of Western Petroleum Refiners Association and National Petroleum Association. He was a member of the Chicago Plan Commission and twice a member of the board of commissioners of Lincoln Park. He is national president of the Navy League of the United States and vice chairman of the joint Army and Navy committee on welfare and recreation.

Sheldon Clark, newly elected chairman of Sinclair Oil Corp. executive committee

Watts, pioneer in the Mid-Continent oil fields, was among the officers of the first Sinclair company in 1916. He has been a director and a member of the executive committee of the parent organization many years. He has been in charge of foreign operations in Mexico, Venezuela, Cuba and elsewhere and for many years president of Sinclair Navigation Co. He was a member of the Planning and Coordination Committee under the NRA, is a member of the principal functional committees for District 1 under Petroleum Administration for War.

Taber since 1923 has been vice president in charge of all refining operations. He received a B.S. degree in mechanical engineering at University of Pennsylvania in 1911 and master's degree at Massachusetts Institute of Technology in 1913.

Stanford, specializing in foreign export operations, has been assistant to H. F. Sinclair several years. He joined Sinclair in 1919. He is a graduate of St. Mary's College.

Plans for Relaxing War Controls Over Industry Are Near Completion

WASHINGTON.—Plans for relaxing many war controls over the petroleum industry as soon as the war ends in Europe are virtually completed, but announcement of the program has been delayed by the critical lag in a few vital war-production programs.

This lag is attributed to a shortage of manpower, which in turn is blamed on a feeling that the urgency of war production has passed and that reconversion is under way. To counter this, James F. Byrnes, newly confirmed director of war mobilization and reconversion, has threatened to put a stop to further reconversion, even on a small scale, and to suspend completely the production of civilian goods in areas of greatest manpower shortage.

For weeks War Production Board has been working with other war agencies in drafting a master industry control plan for application after V-E day, involving dropping the controlled materials plan and all nonmilitary priority ratings. Other war agencies, such as Office of Price Administration and Petroleum Administration for War, have submitted comments as to how this plan would affect their programs, and as a result modifications have been made in it. The revised plan was scheduled for announcement about this time, but probably will be held up because of Director Byrnes' concern over the too rapid trend toward reconversion.

Before drastic steps are taken to stop reconversion, the war agencies will make a determined effort to recruit more men for industries which are particularly behind schedule. This recruiting campaign probably will not cut into the oil industry's present manpower supply seriously but it may increase the difficulties of obtaining men for heavy work in drilling and production operations.

Relaxation Begun in Some Oil-Material Controls

WASHINGTON. — Material controls in certain oil producing, transportation and refining operations have been relaxed by Petroleum Administrative Orders 11 and 15. Under the amendments, operators do not need PAW authorization to use up to $25,000 worth of materials in such operations. PAW permission must be obtained for use of material costing more than $25,000. Previously, a limit of $10,000 had been in effect. Improvement in the supply of critical materials made it possible to relax controls at this time.

The amendment to PAO-11 affects material used in pressure-maintenance operations, gas cycling, gas treating, in natural-gasoline recovery plants and in construction of natural-gas gathering lines. The amendment to PAO-15 affects material for construction of crude-oil gathering lines and other transportation facilities, and for construction purposes in refining operations.

Synthetic-Rubber Plants Near Rated Capacity

WASHINGTON.—Because of a reduction in the requirements of alcohol for synthetic rubber during the fourth quarter, J. A. Krug, chairman of War Production Board, has notified distillers that their facilities for making industrial alcohol will not be needed during January.

Synthetic-rubber plants that produce butadiene from petroleum are now approaching their rated capacities. During the past summer these plants were restricted to low production rates because the butylenes they use as raw material were more urgently needed for the production of aviation gasoline.

THIS WEEK

TRANSPORTATION—New "featherweight" drum will step up flow of aviation gasoline to Chinese front hundreds of thousands of gallons monthly. . . . ¶Oil movement by barges in country's inland waterways will average 1,475,030 bbl. daily in 1944, ODT says. . . . Increase of 18 per cent over 1943. . . . Without this barge support, railroads and pipe lines couldn't move adequate war supplies. . . . ¶Mexico plans construction of four pipe lines costing $11,500,000 and fleet of tankers. . . .

PRODUCTION—New oil-conservation process given public by University of Kansas Research Foundation. . . . Excludes water from wells by injecting oil into water-bearing formations. . . . ¶California's discoveries first 9 months of year, notwithstanding intense drilling activity, add to reserves only one-fifth as much oil as was produced. . . . ¶Country's daily production up 4,450 bbl. to 4,736,300. . . . Principal increases Kansas, 16,700, and California, 7,000. . . . Illinois down 15,400. . . .

FOREIGN—Lord Beaverbrook picked as Britain's probable oil czar. . . . Oil men, pleased with way he presented British case in oil-pact conference, say he is man to represent that nation's oil industry in troublous postwar years. . . . ¶PIWC expected to make its position known at December meeting. . . . Senate committee hearings on pact after new Congress convenes likely to attract attention of other industries which must formulate foreign policies. . . . ¶Major oil company obtains exploratory concessions in Venezuela. . . . Total 750,000 acres, all in most prolific oil zone of eastern Venezuela.

SYNTHETICS—Rubber at 10.7 cents pound predicted by Dr. Semon, who developed synthetic rubber for tires. . . . Prewar price for natural rubber 22 cents. . . . ¶Output of two synthetic-rubber plants in Texas now equal to what could be derived from 28,000,000 trees. . . . ¶Slightly higher prices for gasoline will bring limitless synthetic supply long before petroleum sources are exhausted, J. K. Roberts predicts. . . .

DRILLING—Butler County, Pennsylvania, well, now at 10,059 ft., deepest ever drilled with cable tools. . . . Former record held by Alberta test, 9,700 ft. . . . Texas leads week's completions with 131. . . . Oklahoma next with 58. . . . Michigan's 89 completions in October establish new high for state. . . . Shortage of rigs slowing development of potential oil fields in Mississippi. . . .

WAR—Army reveals secret construction of fuel pipe line across Burma and Calcutta to China. . . . Longest military pipe line in world and almost completed. . . . ¶Fortresses and Liberators strike oil targets in Vienna area. . . . Last great natural sources of petroleum left to Germany. . . . ¶British bombers hit synthetic-oil plant at Dortmund, in Ruhr. . . .

Directional drilling is regular development procedure in the marsh-located Potash field, coastal Louisiana. Included in this group of wells drilled from the same prepared surface site are: One well (center) deflected to an objective about 1,400-ft. distant under the bed of the Mississippi River; another (left), its river-bank offset, deflected to another inaccessible location about 400-ft. distant, and a third (right), the vertically drilled deep-sand discovery well. In the rear is a fourth well, a shallow-sand producer, not entirely completed. An article describing these operations will appear in an early issue.

Synthetic Rubber at 10.7 Cents Is Forecast at Chemists' Meeting

by Arch L. Foster

CHICAGO.—Synthetic rubber can be produced in peacetime at 10.7 cents a pound, in contrast with the prewar market price of 22 cents for natural rubber, Dr. Waldo Semon, director of pioneering research for B. F. Goodrich Co., told the National Industrial Chemical conference here last week.

Dr. Semon, credited with development of the first synthetic rubber used commercially in auto tires, said the 10.7 cents applied to the "most efficient plants" only, since the average cost for the GR-S produced thus far is 34 cents. He also tempered his prediction with a reminder that most of the world's plantation rubber in the 1935-38 period could have been delivered in this country at 12.2 cents a pound, "at present our lowest out-of-pocket cost for synthetic rubber."

For security purposes and regardless of economic factors, there should be a minimum annual production after the war of 200,000 tons of synthetic rubber, Dr. Semon said. Beyond that minimum it "must justify itself on both a quality and cost basis."

The speaker declared that "GR-S is better than the best German synthetic, buna-S; easier to mix and handle, easier to build into finished products, and those products give better performance in service." He cited that Germany was "never able to use more than about 50 per cent buna in tires, whereas the 'S-3' tires on our cars today contain less than 1 per cent natural rubber."

A slightly higher price for gasoline possibly, but no shortage, is seen by J. K. Roberts, director of research for Standard Oil Co. (Indiana), who spoke on "Research in the Petroleum Industry."

"Long before the nation runs out of gasoline due to petroleum shortage," said Roberts, "an increase in price of 5 cents a gallon will bring liquefaction of coal, along with its virtually limitless supply of the basic raw material.

"Research in the utilization of our enormous natural gas production promises to be well worth while. Much effort is being devoted to application of the so-called 'Fischer' process to the manufacture of liquid hydrocarbons from natural gas. No actual large-scale manufacture based on this process is as yet in operation, but the work has been carried to the point where commercially practical processes are assured.

"Other long-range researches intended to increase the supply contemplate the development of petroleum substitutes, as by reduction of tar sands and shale and the conversion of coal to oil. The technology of such processes has been pushed far enough to prove that they are technically sound and workable. The substitutes simply cannot compete economically with petroleum and natural gas at present, but a comparatively small increase in the refinery cost of gasoline would place some of these processes in a favorable light.

"The petroleum industry is faced with immediate postwar problems which at times seem to be only a shade less urgent than those of war research. One of these is 'What becomes of 100-octane gasoline after V-Day?' Superficially, the answer is simple—it simply will not be made beyond the comparatively small quantities required for postwar operations. To the petroleum economist and technologist, however, this is a far from satisfactory answer. Actually, the facilities now employed for manufacture of 100-octane gasoline must be converted as rapidly as possible to manufacture of motor gasoline.

"The principal reason for this is that wartime operations are punishing to the industry's program for efficient crude production and efficient utilization of crude. The industry must return to more efficient operations as rapidly as possible."

The chemical engineer has grown up with the refining industry, Dr. G. C. Brown, head of the department of chemical engineering, University of Michigan, stated in reviewing accomplishments of the chemical engineering profession. In the first World War very little toluene—and that of poor quality—was made from petroleum, Brown said. Now the amount of toluene from petroleum is many times that from all other sources. "The next war," Brown concluded, "will start probably with triptane and rocket bombs."

C. F. Kettering, vice president for research for General Motors Corp., emphasized the necessity for independent thinking and "not taking anything for granted." "When I look at some of the beautiful mathematical and chemical formulae that you engineers work out," he said, "I know that I am not sure of their correctness, that I know little about them and I wonder if you know anything for certain."

New developments in equipment for the refining and chemical industries were displayed by 175 companies showing in the Chicago Coliseum in connection with the chemists' meeting.

What Others Say

Large Profits Not Indicated

Tulsa.

Dear Sirs:

Persons who are unauthorized to do so have made extravagant statements regarding the results of wildcatting operations by Northern Ordnance, Inc., and John B. Hawley, Jr.

As secretary-treasurer of Northern Ordnance, Inc., I wish to state that we have had many independent appraisals and careful checks by our own geologists and petroleum engineers which indicate that we will get a net return after operating expenses equal to, or slightly more than, the return we would have realized after the payment of income taxes had we not engaged in our oil operations.

Any extraordinary profit which may accrue in the future will be a pleasant surprise, but it certainly cannot be anticipated from any data which are presently available.

When we started wildcatting operations 2 years ago the large oil companies had acreage under lease which offered reasonable possibilities for the discovery of oil. We have drilled all of these "farmouts" which offered any reasonable possibility of success and the oil companies have drilled hundreds of other blocks, so that now there are practically no farmouts available.

In concluding our wildcatting operations, we wish to express our appreciation of the complete cooperation we have received from The Carter Oil Co., John Brice, its vice president, and from the other large oil companies who have extended us their complete help, technical services and information which has cost them hundreds of thousands of dollars to acquire.

G. S. DAVIDSON.

Three Suggestions

Denver, Colo.

Dear Sirs:

I agree with the writer in The Oil and Gas Journal, September 16, that the Petroleum Administration for War has done a good job of handling oil problems and is deserving of the highest praise. Further, as a suggestion only at this time, I believe, in regard to postwar policies, there are three spheres of oil-industry action. These are:

1. Private industry to be allowed 10 per cent on its investments in natural resources, such as oil and gas.

2. Subsidies for marginal operators to prevent physical waste of natural resources.

3. Government investigations in fields and research not attractive to private capital.

All can be harmonized, can't they?

Cordially,

FRANK N. BOSCO.

FOUNDED IN 1910

BY PATRICK C. BOYLE

The OIL AND GAS JOURNAL

Economic Research

THE accomplishments of the petroleum industry's technologists in war production are now receiving a partial recognition. When the war's restrictions are lifted, the emergency's technical developments can be fully revealed.

Accompanying these scientific and engineering achievements have been economic studies without which the contributions of research and development laboratories and the fields, plants and pipe lines would have lost much of their effectiveness. Dr. R. E. Wilson, chairman of PIWC's Committee on Economics, appreciated this situation when he explained last month the activities of his working subcommittee to the council with the conclusion: "The industry owes a great deal to the painstaking and expert work of this group of statistical men, who have been too much in the background."

This subcommittee of 17 members drawn from all sections of the country, with its continuous projections of military and civilian demands and supplies, in cooperation with PAW, has furnished an operating yardstick for the entire industry. That these projections have been accurate and adequate is apparent from the fact that all military requirements have been met, along with the maximum possible allocations to civilians.

The industry has had this vital service because its economists were functioning in increasing numbers in prewar days. Groups acting voluntarily had become well trained in the required procedure for cooperative economic studies.

Economic research, which has had such a vital part in directing the war program, must be continued in the postwar period. It is the industry's greatest protection from the threat of permanent federal controls.

A stock argument of those favoring industrial regimentation is that operators acting voluntarily cannot maintain a balance in their own activities. The technological achievements of competitive free enterprises are conceded, but it is claimed that there are constant economic dislocations with social repercussions because of the maladjustments in supply and demand.

The answer to this contention is for managements to place more stress on economic analyses of their own operations in relation to those of the industry of which they are a part. Long and costly periods of overproduction can be avoided and adequate preparations made in advance for any expansion in demands.

Cases can be cited in the oil industry in which individual companies under normal conditions have projected the expanding needs for gasoline, furnace oil and other products over a period of a year within a fraction of one per cent. Projections have not been confined to large areas, but have been broken down into counties and small communities. These estimates of consumer requirements were used to determine the schedules for field, pipe-line, refinery and station operations. Similar investigations often have established the possibilities of outlets for new products, while other studies have revealed assured curtailments in existing markets which, to the uninformed, appeared safe for a long period.

The broad features of this type of information need to be handled on an industry basis. Such a program would not nullify in any way the incentive for individual effort in this field of research, nor would it run counter to antitrust laws. Economic stability will be the reward.

Industry Turns to Aviation for Swifter Transportation Needs

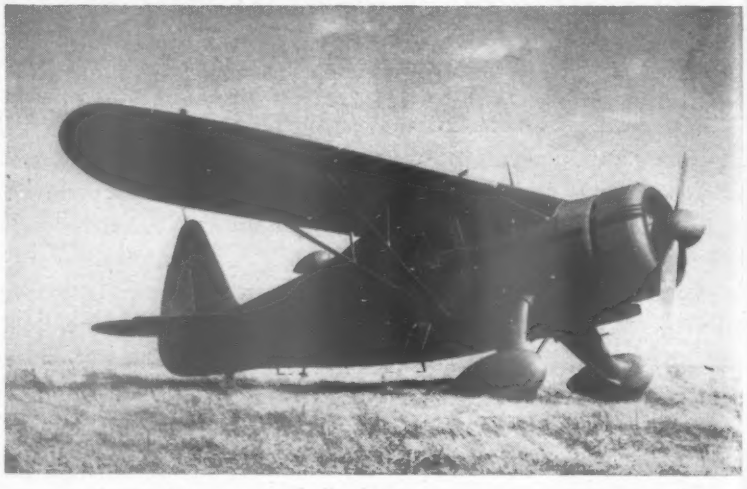
by T. F. Smiley

ENTERING a period calling for swifter, more mobile methods, the oil industry is turning to aviation as the solution of many transportation problems. In preparation for a quickened business tempo oil executives are either buying airplanes or planning for purchases. The oil industry has become an active customer for planes now being made available to essential civilians.

Responses to 44 questionnaires sent by The Oil and Gas Journal to representative oil producers and refiners, drilling contractors, pipe-line men, equipment houses and service organizations show that 11 already have bought 1 to 4 planes. Of the 33 others, 18 have placed orders for aircraft or have made definite decisions to acquire from 1 to 3 planes. The 44 operators plan total purchases of 37 planes of varying size and cost. Of significance is the fact that each of the 11 who now own planes will buy one or more additional units.

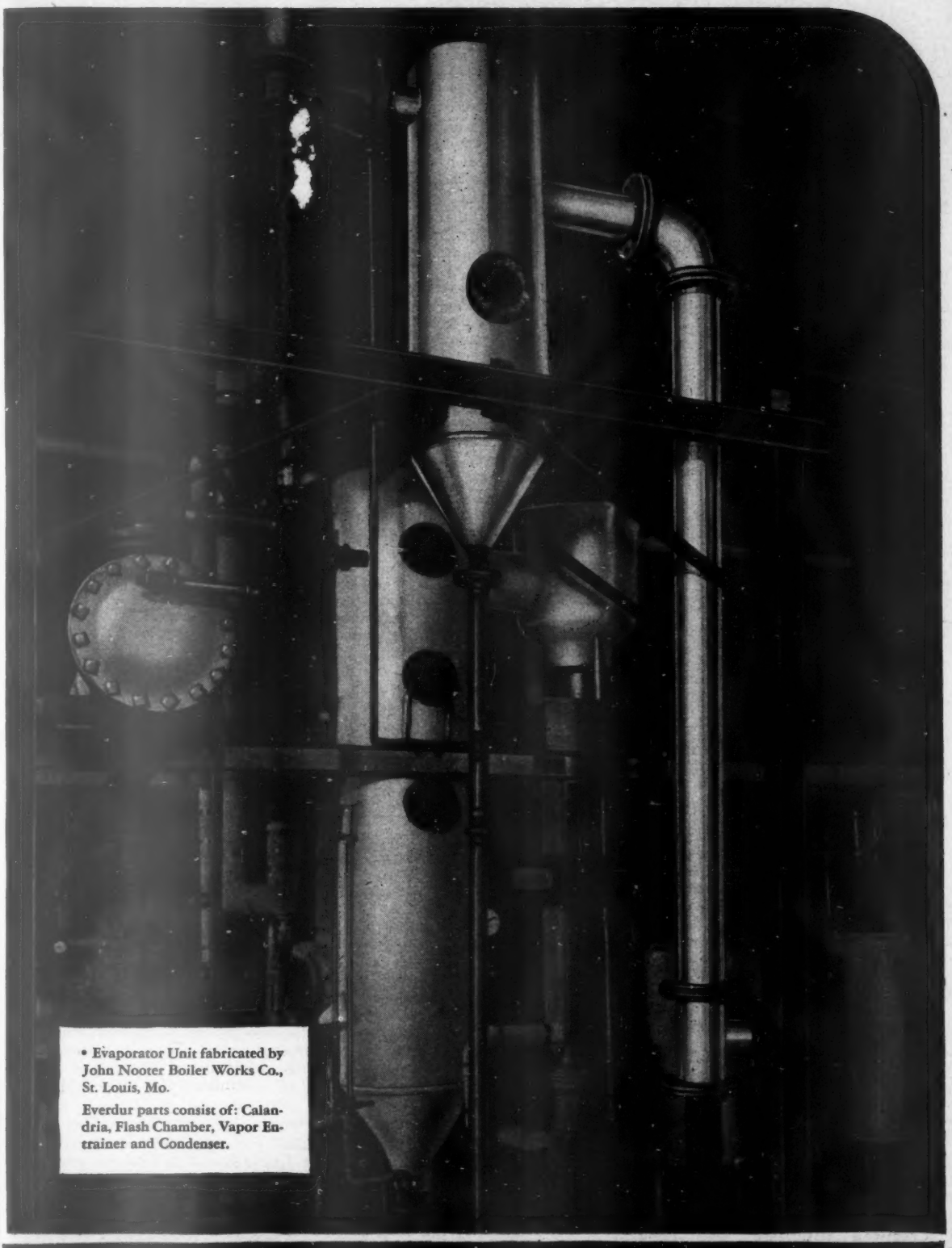
Prices which prospective buyers plan to pay range from "the lowest amount demanded for a trustworthy plane" to $100,000 or more, depending upon the use to which the craft will be put.

The twin-motor type, with capacity of six to eight passengers, leads in point of preference among the prospective buyers. A large number indicate eventual need of two types of plane—a twin-motor ship, with



Warren Petroleum Corp.'s five-place Howard plane for field use

Company	Planes now owned	Expect to buy	For whose use?	Shall you use commercial planes as in the past?
1	0	1	Executives, engineers, construction superintendents	Much more
2	1	1	Executives, geologists, engineers, construction superintendents	Slightly more
3	1	2	Executives, department heads, field men, geologists, engineers	Much more
4	0	0		Same as heretofore
5	0	1	Executives, department heads	Much more
6	0	0		Same as heretofore
7	0	1	Executives, geologists	Same as heretofore
8	0	1	Executives, department heads, field men, engineers	Slightly more
9	0	0		Same as heretofore
10	0	1	Executives	Much more
11	1	2	Salesmen	Same as heretofore
12	0	0		Same as heretofore
13	3	2	Executives, department heads	Much more
14	0	0		Much more
15	0	0		Slightly more
16	4	1	Executives, department heads, field men, engineers	Same as heretofore
17	0	1	Executives	Same as heretofore
18	0	2	Executives, department heads, field men, geologists, engineers	Same as heretofore
19	0	0		Same as heretofore
20	0	0		Same as heretofore
21	0	0		Slightly more
22	0	1	Executives, department heads	Slightly more
23	0	0		Much more
24	0	1	Executives, department heads, geologists	Much more
25	0	1	Executives	Same as heretofore
26	0	0		Slightly more
27	1	1	Executives	Same as heretofore
28	0	1	Executives, field men	Slightly more
29	0	1	Executives, department heads	Much more
30	0	1	Executives, department heads	Much more
31	2	1	Executives, department heads, field men, geologists, engineers	Same as heretofore
32	1	1	Executives, engineers	Much more
33	0	1	Field men	Same as heretofore
34	0	0		Same as heretofore
35	1	2	Executives, department heads, field men, engineers	Much more
36	0	0		Much more
37	0	1	Executives	Much more
38	0	1	Salesmen	Same as heretofore
39	1	2	General use	Much more
40	0	0		Same as heretofore
41	2	1	Executives, department heads, field men, geologists, engineers	Same as heretofore
42	0	0		Much more
43	0	1	Executives	Much more
44	0	3	Field men, geologists	Same as heretofore
Total	18	37		



• Evaporator Unit fabricated by John Nooter Boiler Works Co., St. Louis, Mo.

Everdur parts consist of: Calandria, Flash Chamber, Vapor Entrainer and Condenser.

Made by The American Brass Company

accommodations for at least six passengers, to be used by executives, and smaller planes to move men and materials to and from operations. Interest is expressed in the helicopter for patrolling pipe lines.

Uses of the airplane vary with different companies, but virtually all expect air travel to become increasingly important. Marked expansion of commercial air lines is looked for, and some operators are so situated that most of their needs can be met by these lines.

In the accompanying table each number in the first column represents a company or an individual from whom the Journal has received the information which the table provides.

Increases Granted to 26 Stripper-Well Areas

WASHINGTON. — Twenty-six additional stripper-well areas have been granted increases in their ceiling prices under the stripper-well premium payment plan, Office of Price Administration announces. Increases previously granted to four areas have been revised. The changes are effective as of November 1.

First Wall Creek and the Shale area in the Salt Creek field, Wyoming, formerly allowed an increase of 35 cents a barrel, get a revised increase of 20 cents. Second and Third Wall Creeks in the same field are brought under the plan for the first time, at an increase of 20 cents. These four parts of Salt Creek are now treated as one pool, with a uniform increase. The Morrison pool in Salt Creek field, involving only one well, continues under the plan at the same increase of 25 cents.

The two other revisions are in the Piggot pool, Oklahoma, formerly allowed an increase of 25 cents, now revised to 35 cents; and Blackwell pool, Texas, given a revised increase of 25 cents, instead of the former increase of 20 cents.

The additions to the former list, and the revisions, with the new prices, follow: **Illinois** — Waggoner and Raymond pools, 35 cents. **Indiana**—Prairie pool, 35 cents. **Kansas**—Baldwin, De Moss, Soeken, and Iuka-Arbuckle and Kuske pools and all pools in east half of Elk County, 35 cents; Ponce pool, 25 cents; Cross and Bird pools, 20 cents. **New Mexico**—Leo pool, 25 cents. **Oklahoma**—March (Layton-Skinner), Wewoka (Hunton lime), Tull, Hobbs, South Candy Creek, South Kesishke, Price, Breene and Piggot pools, 35 cents; Cromwell (Gilcrease) and Long pools, 25 cents. **Texas** — Blackwell pool, 25 cents. **Wyoming**—Pilot Butte (Upper light oil) and Greybull pools, 35 cents; Salt Creek (first, second, and third Wall Creek and Shale area), 20 cents.

Beaverbrook Expected to Be Britain's Oil Czar

LONDON.—Naming of Lord Beaverbrook as Great Britain's petroleum czar is predicted by close friends of the newspaper publisher. Oil men searching for somebody capable of representing them in troublous postwar years, view the plain-speaking Beaverbrook as a logical selection.

Impressed by the way in which the Canadian-born peer presented the British case in the Washington oil conference, they think the uncompromising fighter would be of tremendous use in battle for retention of Britain's place in oil affairs.

Informal approaches made to Beaverbrook after he returned from Washington have been renewed, those around him say. According to these sources, Beaverbrook again is out of favor with the Churchill cabinet following a bitter critical analysis of the postwar prospects of British civil aviation.

The forthright Beaverbrook is not expected to be satisfied much longer with his present job as lord privy seal in the government, his fifth government post. He would be quite at home in a job such as that offered him by the oil companies.

It is definite that Beaverbrook will take no government part in postwar civil aviation, notwithstanding intimate knowledge of civil aviation affairs. The manner in which he has aired his views, in public and in private, on the need for a definite government policy in civil aviation precludes any such appointment for himself.

His report to the cabinet as chairman of the Civil Aviation Transport Committee is never likely to be made public, since Beaverbrook did not mince words in his summation of the committee's findings.

Ceiling for Reusable Pipe Is Raised $8 a Ton by OPA

WASHINGTON. — Sellers of reusable iron and steel pipe in Georgia and New Mexico have been granted an increase of approximately $8 a ton by Office of Price Administration to compensate them for high freight rates. This action, effective November 20, transfers Georgia and New Mexico from their present zones to zones entitling sellers to higher ceilings. The new ceilings will enable sellers to absorb their excessive freight costs and will facilitate the movement of reusable pipe into the two states.

Texaco to Give War Bonds To Its Men in Service

NEW YORK.—A $100 war savings bond will be purchased by The Texas Co. during the sixth war loan campaign as a Christmas gift for each of its employes on military leave of absence, Harry T. Klein, president, announces. Last year each received a $50 bond. More than 5,000 Texaco men and women are serving with the armed forces. "Many have been decorated for bravery," says Klein. "One has received the Congressional Medal of Honor."

Journal's Postwar Analysis Widely Commended

THE special Postwar Section of the November 18 issue of The Oil and Gas Journal was being widely commended the first of the week by readers in all divisions of the petroleum industry. Enthusiastic comments were proof that the Journal's editors had been successful in their efforts to present to the industry a concise and complete preview of probable economic and technical trends through the 6-year period which starts January 1.

Those who had time to study the entire 32-page report were particularly enthusiastic regarding the use of multi-colored charts, graphs, and other illustrations in presenting vital data in a manner never previously attempted in trade journalisms. Typical of the laudatory comment was that of C. C. Herndon, vice president of Skelly Oil Co., who wrote:

"An examination of the current "Postwar Number" of The Oil and Gas Journal moves me to congratulate you and your colleagues on an extraordinarily fine job of trade journalism. The postwar section is not only well conceived and practically useful in its content, but its mechanical form is the most attractive that I have seen in any publication—trade or otherwise—for a long time.

"The industry has long owed much to your paper and you gentlemen seem determined by alert and forward-looking policy to make the magazine more and more serviceable.

"Best wishes to you all.

"Sincerely yours,
"CHESLEY C. HERNDON."

Oil-Conservation Process To Be Given to Public

LAWRENCE, Kans.—A new process for conservation of oil, developed by Dr. Eugene A. Stephenson, will be given to the public by the newly incorporated University of Kansas Research Foundation. Dr. Stephenson, director of the foundation, said he had given all his patent rights to the research group, and that organization in turn has taken steps to make the method available to the oil industry without charge.

The process provides for exclusion of water from oil wells by introducing oil into the water-bearing portion of the producing formation. Three oil companies, Phillips Petroleum Co., Cities Service Oil Co. and Stanolind Oil & Gas Co., which helped to finance the research, have licenses to use the process, but they have assigned all their rights except shop rights to the research foundation with the understanding that they shall have the use of the process in their own wells without charge regardless of what negotiations or developments may be made by the foundation.

"Dr. Stephenson and the Research Foundation have made this new process available to the oil industry," said Chancellor Deane W. Malott, "because they believe that it will aid in exclusion of salt water from oil wells and thereby tend to prevent stream pollution, reduce operating costs generally, and increase the ultimate production of oil."

Dr. Stephenson, in directing the research on the water-exclusion process, was assisted by P. T. Amstutz, Jr., now with the Standard Oil Co. of Ohio.

Phillips Gets Concessions In Eastern Venezuela

BARTLESVILLE, Okla. — Phillips Venezuelan Oil Co., subsidiary of Phillips Petroleum Co., has obtained from the oil ministry of Venezuela four exploratory concessions totaling 750,000 acres and three parcels of national reserve leases totaling 26,000 acres, it was announced here last week by Frank Phillips, chairman, and K. S. Adams, president, of Phillips Petroleum Co.

The announcement said all these properties are in the Maturin basin, most prolific oil-bearing zone of eastern Venezuela. Two of the concessions are in the state of Guarico and two in Anzoategui. The national reserve leases are in Monagas, near and in the trend of the oil fields of Jusepin, Mulata and Santa Barbara.

Phillips Venezuelan Oil Co. has established headquarters at Caracas and will start exploratory operations on the concessions soon.

Adams is president of the Venezuela subsidiary of Phillips, and Don Emery, general counsel of Phillips, is executive vice president. The management of the company in Venezuela will be announced soon.

OPA Announces Merger Of Rationing Divisions

WASHINGTON.—The fuel-rationing and automotive supply-rationing divisions of Office of Price Administration have been consolidated, Max McCullough, deputy administrator for rationing, announced.

John G. Neukom, who was head of the fuel-rationing division, is director of the new division, with Fred L. Parker, chief of the stove-rationing branch, associate director. Richard C. Harrison, director of the automotive supply-rationing division, continues as a consultant on mileage rationing.

The new division, designated the fuel and automotive-rationing division, has five branches, as follows: Gasoline, Quentin Regestein, chief; fuel oil, James C. Scully, chief; tires, John C. Mann, chief; consumer durables (automobiles and stoves), James Boyd, chief; Northwest solid fuels (headquarters in Seattle, Wash.), James J. Miksak, Seattle, chief.

Another Tensleep Strike For Wyoming

DENVER. — Sinclair-Wyoming Oil Co. 1 Unit, SW NW NW 14-32n-95w, in the Big Sand Draw field, Fremont County, Wyoming, found top of Tensleep at 7,220 ft., total depth 7,338 ft., made drill-stem test with packer set at 7,266 ft., and 1,000 ft. of water cushion. In 2 hours recovered 160 ft. of mud, 6,100 ft. of oil (35.5° gravity), no water.

Tide Water Posts Prices For Oklahoma Crude

Tide Water Associated Oil Co. has posted the following prices, effective August 1, for crude oil purchased in Oklahoma fields: Below 21° gravity, 85 cents, with 2-cent differential, beginning with 87 cents for 21 to 21.9 gravity, to a top of $1.25 for 40 gravity and above.

DEATHS

Lt. Col. H. K. Wesson, 32, employed in the accounting department of Helmerich & Payne, Inc., oil operators and drilling contractors, Tulsa, when he entered war service as a reserve officer, died October 15 from wounds suffered in action in the German theater 2 days earlier. Colonel Wesson, a graduate of Oklahoma A. & M. College, had been awarded the Bronze Star, four Oak Leaf Clusters, and the Purple Heart.

Peter F. Johnson, 81, oil producer of Monroe, Pa., died November 6.

Conway Stroud, 51, independent oil operator in North Louisiana for 25 years, died in Shreveport November 14.

Don Waite, manager of the Jarecki Manufacturing Co. store in Tulsa when he enlisted in the Navy, was killed in action in the Leyte invasion.

A. L. Schellhemmer, one of the founders of Denver Producing & Refining Co., died recently in Warren, Pa.

Joseph Smith, 68, retired district pipe-line superintendent for Magnolia Pipe Line Co. at Olden, Tex., died at his home in Eastland, Tex., November 15.

George A. Duncan, 21, employed in the American Gas Association testing laboratories, New York, when he enlisted in the aerial arm of the Navy in 1942, was killed in action September 13, the Navy Department has revealed. Duncan, a petty officer, had participated in 26 aerial engagements at sea against the Japanese, and he is believed to have been shot down in the battle of Palau.

Cpl. Emmett H. Daly, Jr., 30, a junior clerk in the accounting department of Stanolind Oil Purchasing Co., Tulsa, when he entered war service, was killed in action in France October 29. Daly graduated from St. Benedict's College, Atchison, Kans. His father is president of Papoose Oil Co.

Elmer E. Howe, Sr., 83, oil producer of Red Rock, Pa., died November 15. With his father, Henry Howe, he was a pioneer operator in the Bradford field, and upon the death of Henry Howe in 1883 he took over operation of their oil properties.

H. H. Franks, 73, president of Franks Manufacturing Corp., Tulsa, until his retirement 3 years ago, died November 17. He was active in the development of truck-mounted drilling rigs and other mobile oilfield equipment.

Robert H. Breckon, Saskatchewan oil pioneer, died recently in Saskatoon, Sask. As president of Vera Oilfields he was prominent in exploratory work in the Vera-Unity area of western Saskatchewan, and he had been active in the Kevin-Sunburst and Alberta fields.

North Burbank May Be Largest Individual Secondary-Recovery Reserve

by Kenneth B. Barnes

One of the country's largest gas-drive operations has been under way at North Burbank for several years, and current production continues at maximum level. It is indicated the gas return will serve only as an "intermediate" recovery phase, with a huge reserve possibly present for applied water drive. For a summary of the status, note figures in box on opposite page.

THE North Burbank pool, located in western Osage and Kay counties of northern Oklahoma, may be classifiable on a number of counts as the largest individual secondary-recovery reserve in the world. At the present time it is serving as a proving ground for many developments in gas repressuring and many useful factual data have been accumulated under that mode of operation. This process, however, will be in total but moderately effective as a final recovery agent and the pool is believed to offer large potentialities in the future for artificial water-drive application.

The water-drive phase seemingly has such good prospects that if future field developments along those lines are in accord with present expectations, a new span of drilling, systems installations, water injection, etc., will be entailed that will cover a time interval on the order of 50 years.

The general area, moreover, is of unusual interest in that there are other nearby pools of the same general reservoir character which are being repressured or gas driven but in somewhat different manners. The connecting South Burbank pool originally was operated under a gas-return pressure-maintenance program but more recently under a modified gas-drive arrangement. Many innovations in production practices were introduced in this project. Also nearby is the Naval Reserve pool which is featured by the presence of a large dry gas cap at the apex of the structure. Here the gas cap, because of varied ownership considerations, is being held in situ and gas is being returned to the oil belt along the flank. Each of these three pools is similar in that the Burbank sand of Pennsylvanian age, lying at a depth of 2,900 ft., is the sole producing formation, although North Burbank is five times larger than either of the others. Because there are so many phases in the North Burbank operation alone of interest to the production man and petroleum engineer, discussion of the South Burbank and Naval Reserve projects cannot be given at this time.

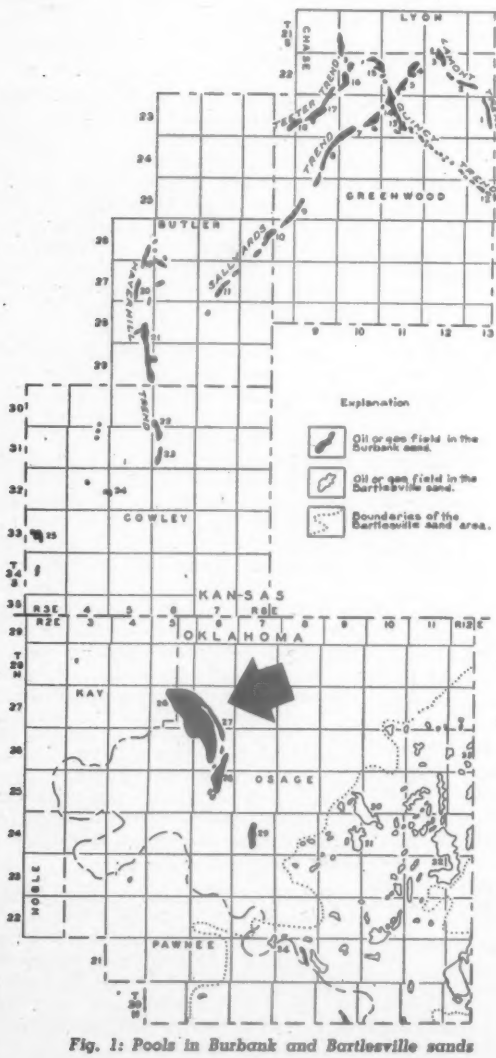


Fig. 1: Pools in Burbank and Bartlesville sands

No. on map	Name of oil field
1	Shambaugh
2	Lamont
3	Fankhouser
4	Madison
5	Wick
6	Burkett
7	Thrall
8	Agard
9	Sallyards
10	Blankenship
11	Keighley
12	Quincy
13	Edwards Extension
14	Seeley
15	DeMalorie-Souder
16	Browning
17	Teeter
18	Scott
19	Smock-Sluss
20	Haverhill
21	Fox-Bush
22	Eastman
23	Burden
24	Windfield
25	Rainbow Bend
26	Burbank
27	Stanley Stringer
28	So. Burbank
29	Naval Reserve
30	Pershing
31	Wynona
32	Avant
33	Bartlesville
34	Boston

Comparison With Other Secondary Areas

In classifying North Burbank as the largest individual secondary-recovery reserve a number of comparisons and qualifications naturally are in order. At the present time 100 per cent of the productive area of the pool is being affected by low-pressure gas drive. In amount of area, the K.M.A. pool of North Texas, as a gas-drive operation, covers 30,079 acres and is larger than North Burbank with 22,710 productive acres. The original drilling at North Burbank covered approximately 25,000 acres but the extreme outside area and thin sand portions were relatively marginal and, after producing for 5 to 10 years, were plugged and abandoned. However, North Burbank has a larger reserve

in place, has 298 gas input wells in contrast to approximately 100 at K.M.A., and the gas-injection volumes are 25,000,000 cu. ft. per day as against approximately 10,000,000.

As a potential applied-water-drive operation, North Burbank is believed to have a reserve of rather outstanding amount with the figure lying in the range of 250 to 320 million barrels. This estimate has considerable backing in past production performance, volumetric reservoir data, and recent core-analysis studies. These may be coupled with the fact that in a small localized area in the extreme northwest portion of the pool a natural water drive is present which is effecting exceptionally high recoveries. The water influx rate is low and the territory embraced by the encroachment so small, however, that the section may be considered as only illustrative of the benefits of water drive in Burbank sand. In comparison to other artificial water-drive reserves, for example, such pools as Nowata-Childers in northeastern Oklahoma and the Bradford pool of Pennsylvania, have perhaps larger amounts of acreage yet to be water flooded, but as a whole the North Burbank reservoir seemingly has the largest potential reserve in barrels.

Single Royalty Interest Facilitates Program

In the present gas-drive operations an unusual spirit of cooperation prevails among the different operators in that gas-input-well trades, cooperative gas-injection agreements and the like are quite common, and in that certain gas-transmission, compression facilities, etc., pertaining to the repressuring have not been duplicated, regardless of the checkerboard ownership prevailing in many portions of the pool. The fact that there is but one common royalty interest for all of the pool except for the small portion lying in Kay County has, of course, greatly facilitated the expansion of the repressuring to cover all of the acreage in relatively short time. In the future, when water-flooding methods may be employed, this again will eliminate one ordinarily very troublesome factor.

Geology

During Mississippian time a basin was formed in the area by the Ozark uplift on the east and the Central Kansas and Nemaha uplifts on the west. The Cherokee series of sands and shales were laid down, first in the eastern portion and in part there formed the blanket-like Bartlesville sand. Later, in the western portion, a trend of sand bars were formed by the fluctuating shore line of the Pennsylvania sea. These Burbank sand lenses, of undulating thickness,

THE STATUS:

Oil Production to Date, Barrels	**214,101,809**
Oil Production Rate, Current, Barrels Per Day	**8,850**
GAS DRIVE:	
Additional Oil Recovery by Repressuring to Date	**15,000,000**
Additional Oil Recovery by Repressuring, Future Reserve	**35,000,000**
Additional Current Oil by Repressuring, Barrels Per Day	**6,800**
Additional Current Increase by Repressuring, Per cent	**340**
Gas Injected to Date, Cubic Feet	**64,000,000,000**
Gas Injection Rate, Current	**25,000,000**
GASOLINE PLANTS:	
Gasoline Manufactured to Date, Gallons (Approx.)	**1,100,000,000**
Gasoline Reserves Under Repressuring, Gallons	**275,000,000**
WATER DRIVE:	
Potential Reserve (in addition to repressuring reserve), Barrels	**250,000,000 to 320,000,000**

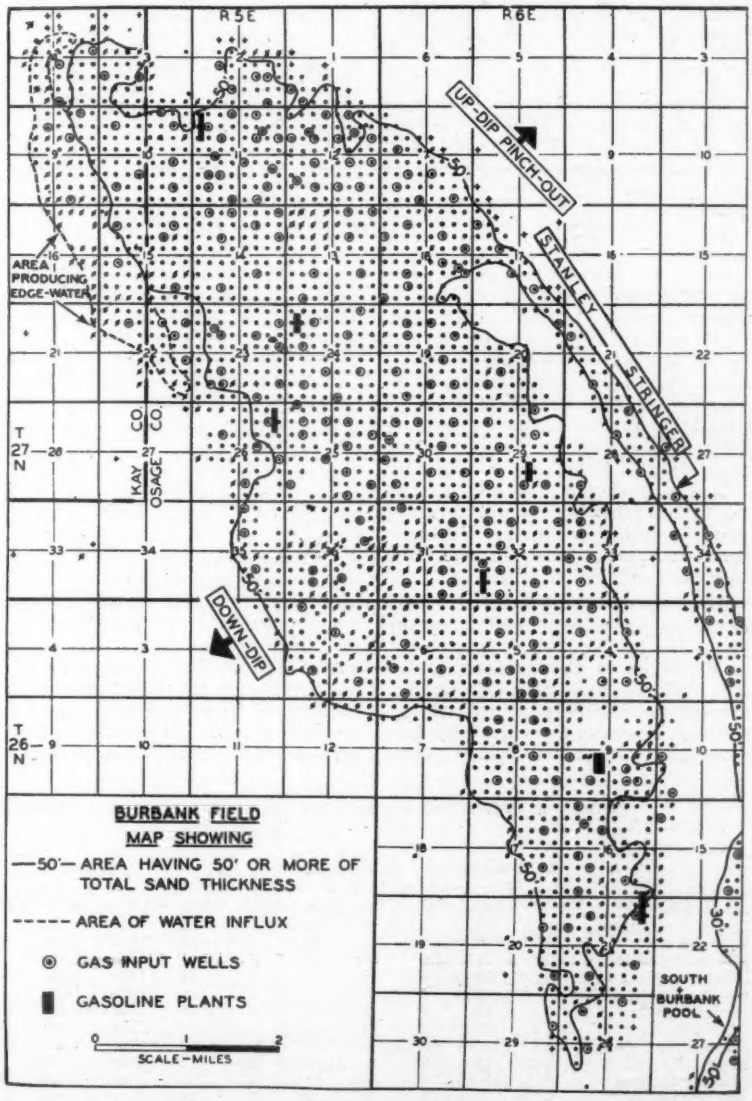


Fig. 2: Map outlines productive area of 50-ft. or more sand thickness, injection wells, gasoline plants, and northwest water edge

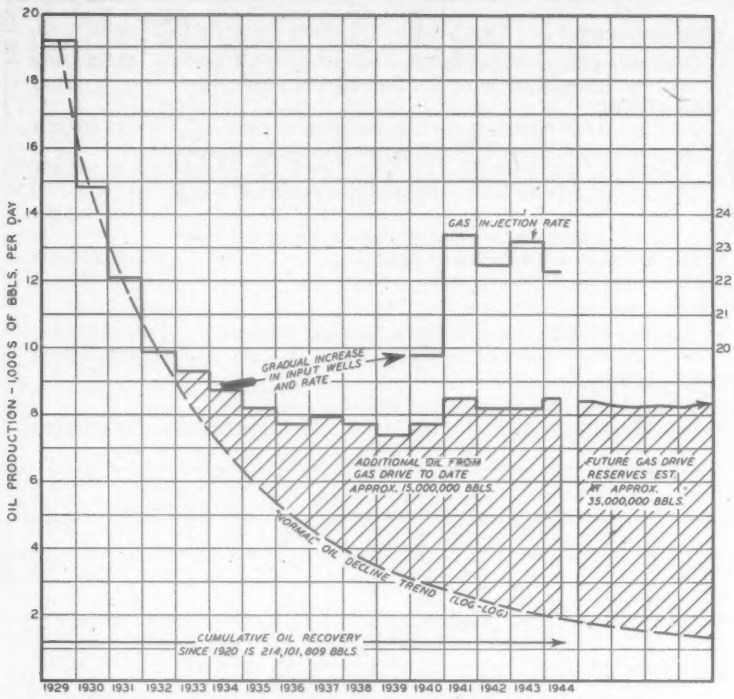

OIL PRODUCTION - 1,000'S OF BBLS. PER DAY
GAS INJECTION - MILLION FT. PER DAY
GAS INJECTION RATE
GRADUAL INCREASE IN INPUT WELLS AND RATE
ADDITIONAL OIL FROM GAS DRIVE TO DATE APPROX. 15,000,000 BBLS.
FUTURE GAS DRIVE RESERVES EST. AT APPROX. 35,000,000 BBLS.
"NORMAL" OIL DECLINE TREND (LOG-LOG)
CUMULATIVE OIL RECOVERY SINCE 1920 IS 214,101,809 BBLS.
1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941 1942 1943 1944

Fig. 3: Graph showing "normal" oil decline and actual production under gas drive, cumulative production, and gas input rates

occur in the western side of the area in long narrow chain-like productive groups which extend from the "Golden Lane" territory of Greenwood and Butler counties of eastern Kansas southwardly through the Burbank region. After the Cherokee deposition further Ozark movement later gave a westwardly dip to the area of about 30 ft. per mile. In Fig. 1 is a map showing the North and South Burbank and Naval Reserve pools, together with the Burbank sand trend northward and the Bartlesville sand region to the east.

The Burbank sand in the pool varies from a few feet in thickness to about 100 ft. The bulk of formational data lies in the original cable-tool drill logs, and these show that virtually all of the pool inward one to three locations from the edge has a total sand thickness of 50 ft., with good part of various central sectors running 60, 80, and upward to the maximum of 100 ft.

Interconnection of North and South Burbank Through the Stanley Stringer

The gradual discovery, as drilling progressed, of the interconnection between North and South Burbank through the Stanley Stringer, is a geologic feature of importance. North Burbank was developed principally in 1921-1923, with most of the east-side productive limit soon becoming well defined. In 1926, however, a narrow productive strip, paralleling the east side, was discovered and developed. This Stanley Stringer proved to be but ½ mile wide, although 7 miles long. The Stanley Stringer is considered a part of the North Burbank pool and in this article the repressure and reservoir data for the two are consolidated.

It was not until 1934 that wildcat drilling a few miles to the south of the Stanley Stringer brought the discovery of the South Burbank pool. Here in 2 years 4,160 productive acres were delineated, and in the process the sand correlated through and showed connection to the wells in the Stringer.

Growth of Gas Repressuring

First gas injection to the producing formation at North Burbank was started in 1926. By this time the oil production had declined substantially, and practically all the wells were on the pump. Additional input wells gradually were added and as the beneficial effects became more apparent the economics of purchasing outside gas for increasing injection rates gradually were established.

On a typical 160-acre lease, with with 12 to 16 producers, one to two wells could be placed in injection service at rates of about 50 m.c.f. per day and the oil production doubled. A 20-bbl.-per-day property could be brought up to 40, a 50-bbl. property to 100. Some properties responded better, others not quite so good, but virtually none were failures.

Present Pool-Wide Gas Return

The present pool-wide gas drive and a firm understanding of the necessity of high-rate gas injection at all portions of the reservoir really came about in February 1939 when the North Burbank-Stanley Stringer-South Burbank areas were officially delineated as one common reservoir, together with the Osage Agency requirement that gas produced from the joint pools, after processing, was to be returned to the producing formation. At the time, large excess quantities of residue gas were available in the South Burbank pool, and the engineer representatives of the operators arranged a system of transportation, metering, distribution, and accounting to enable the surplus gas to be used for repressur-

TABLE 1—OPERATIONAL STATUS OF NORTH BURBANK REPRESSURING FOR SEPTEMBER 1944

Operator—	No. leases	Oil wells		Input wells		SWD wells	Total wells	Production		Gas injection		Gas-oil ratio		Oil B/D, Aver. per well	Av. M/D, Per input well
		Oper.	S.D.	Oper.	S.D.			Oil B/D	Gas M/D	M/D	% avail. residue inject.	Gross	Net		
Dye & Tomlinson	1	6	0	0	0	0	6	16	21	0	0	1,329	1,329	2.7	0
Gulf Oil Corp.	16	160	4	28	2	1	195	938	3,260	2,541	135	3,474	766	5.9	91
Kewanee Oil Co.	8	64	1	14	1	0	80	611	1,870	1,676	179	3,060	313	9.5	120
Magnolia Pet Corp.	10	43	1	8	0	1	53	854	1,758	1,061	110	2,060	818	19.9	133
Mid-Continent Pet.	3	43	0	5	0	0	48	325	568	275	124	1,747	901	7.6	55
Moore Oil Co.	2	15	0	3	0	0	18	46	208	189	127	4,512	400	3.1	63
Ohio Oil Co.	5	27	2	3	1	2	35	200	387	313	....	1,937	372	7.4	104
Phillips Pet. Co.	105	825	105	140	47	23	1,140	4,832	19,220	15,783	148	3,977	711	5.9	113
Royal	2	16	1	2	0	0	19	82	103	50	....	1,264	655	5.1	25
Sinclair Prairie	16	174	7	15	17	0	213	679	1,809	1,024	114	2,662	1,154	3.9	68
Skelly Oil Co.	4	19	3	6	0	1	29	75	470	209	126	6,250	3,469	4.0	35
Texas Co.	8	74	0	6	0	0	80	102	571	251	81	2,965	1,662	2.6	42
Total	180	1,466	124	230	68	28	1,916	8,850	30,245	23,372	145	3,417	776	6.0	102

ing at North Burbank at very nominal cost.

Reports and Engineers' Meetings

A cooperative pool engineer was employed by the participating operators to handle the gas distribution and accounting, prepare monthly reports, and conduct periodic informal operational meetings. All companies increased their number of injection wells, and the total input rate reached 25 million feet per day and oil production increased from 6,886 to 9,381 bbl. per day by August 1941. However, in October 1941, the supply of South Burbank gas became unavailable through a rearrangement of the gas-return program there.

Outside Source of Repressure Gas

In view of the elimination of the major source of makeup repressure gas, Phillips Petroleum Co. made a substantial advance in capital investment for the construction of a trunk pipe line to connect with another source of gas. This alleviated the scarcity of gas, and later Cities Service Gas Co. constructed a 26-in. line eastward from the Hugoton area which is interconnected through to the Burbank system. By these developments, an assured supply of gas is available to all Burbank operators at a common, reasonable price, under pressure sufficient for injection. Local field distribution and metering charges from well to well are nominal.

The foregoing highlights of the history of handling makeup gas at North Burbank, while interesting as a recount of the complexities involved in that phase for a major gas-drive operation, also are indicative of the value of conserving gas from a reservoir for recovery and operational purposes.

Repressure Data and Status

A map of the pool is given in Fig. 2 showing location of gas input wells, gasoline plants, Northwest water encroachment area, etc. It will be noted that all of the area was developed uniformly on 10-acre well spacing. The gas-input wells, with a score of exceptions, have all been converted from former producing locations. Input-well density varies from 1 to 4 per 160 acres. Selective injection to specific portions of the total sand section is not done, as all of the oil wells from which the conversions were made originally were heavily shot.

One operator has drilled some 25 special wells, part for five-spot gas-injection service, and part to secure specific core data on different spreads of leases for information relative to water drive application. The five-spot input wells are located mostly in the north-central part of the pool.

TABLE 2—VOLUMETRIC DATA AND WATER DRIVE YIELDS

	Barrels per acre-foot	Barrels per acre	Total pool
Formation pore space	1,320	62,600	1,421,000,000
Interstitial water content	370	17,550	399,000,000
Original reservoir crude	950	45,050	1,022,000,000
Original stock tank crude (1.2 FV)*	792	37,550	852,000,000
Ultimate recovery at end of gas repressuring	231	10,950	249,000,000
Oil remaining at end of gas repressuring	561	26,600	603,000,000
Water-flood reserve, to 25 per cent residual oil	231	10,950	249,000,000
Water-flood reserve, to 22.5 per cent residual oil	264	12,500	284,000,000
Water-flood reserve, to 20 per cent residual oil	297	14,075	320,000,000

*FV = formation volume factor of crude.

In Table 1 are listed pertinent well and production data for the 12 operating companies for the month of September 1944.

As of September 1, 1944, the North Burbank pool has produced 214,101,809 bbl. of oil (9,430 per acre). Of this, the gas-drive effort to date has been responsible for the recovery of 15,000,000 bbl. This is the actual record over the normal decline expectancy. The year-to-year progress is shown in Fig. 3 where the normal oil decline trend, from log-log extrapolation, is plotted together with the actual oil production and gas-injection volumes.

Removal of Vacuum

Up to September 1939 all casinghead gas was gathered by the gasoline plants under a field rule limiting maximum vacuum at the well heads to 10 in. of mercury. The repressuring by this date had spread to where the operators were desirous of removing all vacuum effect and confining more and more gas pressure to the reservoir. Accordingly a pool-wide vacuum-reduction program was started, the original rate being 1 in. per month. This rate proved too rapid to maintain oil production on a uniform level, and many leases dropped precipitously. Thereafter the vacuum was lowered more slowly, with all of it being taken off in 17 months. The leases which had declined soon regained their former status, and shortly after the program was completed oil production was higher than before.

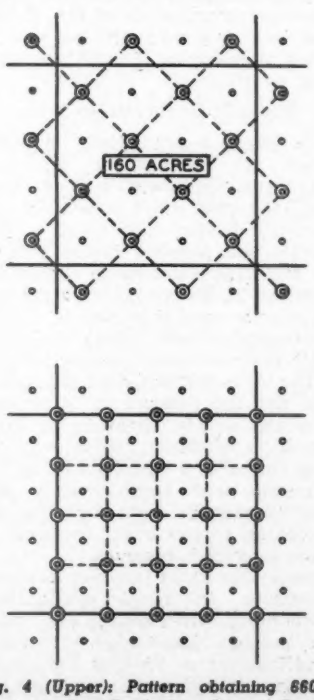


Fig. 4 (Upper): Pattern obtaining 660-ft. input to oil well spacing. (Lower) Pattern yields 467-ft. spacing

Each lease has a vacuum regulator installed shortly downstream from the casinghead gas orifice meter. A maximum of 2-in. of vacuum is permitted at the meter setting; the pressure at the individual well heads varies from atmospheric to a number of pounds.

Gas-Injection Rates and Pressures

Average rate of gas injection per well is approximately 100 M.c.f. per day. Maximum rates used are about 250. Injection pressures vary from about 10 to maximum of 300 p.s.i. The west-side injection pressures are low, as are those in the Stanley Stringer; pressures in the south and northeast areas are the highest. Orifice meters are maintained on individual input wells; many are equipped with 7-day clocks. Input wells give little trouble; sometimes a "salted up" condition occurs and the holes are "washed down" with a few barrels of fresh water to remove the obstruction.

Pumping Equipment; Testing

Most of the properties are produced by central powers, except in the northwest water edge where medium-capacity individual units are used. Majority of oil wells are fitted with orifice plate flanges on the casinghead gas lines to permit gas production measurements, and allow restrictions to balance the gas withdrawal rates between wells. Periodic individual well tests are made using either 12, 24 or 50-bbl. test tanks with a motorized pump, or separate lead lines to test storage at the tank batteries.

With the single royalty interest that covers all of Osage County, consolidation of the oil runs from the original individual 160-acre tracts there has been possible in

many cases. The Phillips company owns a number of large contiguous tracts where this has been advantageous. In order, however, to trace down production fluctuations to specific wells within these large groups, production from each 160 acres that is run to consolidations of 6, 8, 10, etc., such tracts also is measured separately. In some cases this is done with test tanks and thiefs, elsewhere a separating tank receives the oil and water from the wells and disk meters register the volume of the separately outflowing oil and water. A float in the tank, on oil-water contact, controls a valve to the oil meter and another to the water meter. Downstream from the meters the oil and water are commingled with the water separated again at the consolidated battery where it is delivered to a disposal system which injects to the producing formation at advantageous spots.

Analysis of Gas Repressuring

Previously in this article, the additional oil by gas drive to date has been shown to be 15,000,000 bbl., with future reserves by continued operation to be approximately 35,000,000 bbl. The latter figure, in part, is based on oil removed and slope or increase in produced gas-oil ratio, which in essence is a relative permeability-saturation relationship. In addition, to the present time, the gasoline plants in the field have extracted approximately 1,100,000,000 gal. or 26,000,000 bbl. of gasoline. The fraction of this recovery which may be definitely attributed to the gas-return program cannot be precisely stated, for such figure requires analysis of the consolidated past operational data and curves for each of the gasoline plants over their past history. Furthermore, there are several different bases for such computations and various complexities of economic viewpoints. Actually, some of the smaller plants before now would have passed their economic end point had it not been for the injection program.

Over the "normal" trend or expectancy to date, the increase in actual gasoline yield by repressuring has been possibly on the order of 40 per cent. Although gas yields have been reduced from about 6 g.p.m. before repressuring to 3 or so now, the increase in raw incoming gas has more than compensated the difference. Under continued operation the pool has a future gasoline reserve on the order of 250,000,000 to 275,000,000 gal.

The above status shows substantial past results and a sizable future. Still, the operation is no bonanza; economical procedures were necessary and a host of operational details had to be performed. A total of 64,000,000,000 cu. ft. of gas has been injected into the reservoir to date. Average well production is only 6 bbl. per day and of the total 1,467 active producers only one-half recover 3 bbl. per day or less. A number of properties have had recoveries in the range of 20,000 to 25,000 bbl. per acre; however, the pool-wide average is only 9,430. Some few leases now are not far from their economic limit under gas drive.

The gas drive has been a good intermediate recovery agent. Without it, the "normal" trend curve shows the oil production at this time would be approximately 2,000 bbl. per day or 1¼ bbl. per day per well. The accumulative production now would be 199,000,000 (8,750 bbl. per acre) and the normal ultimate would be indicated as about 210,000,000 bbl. or 9,240 per acre. Under continued repressuring it will be approximately 249,000,000 bbl. (10,950 per acre). Thus, there is a 6,800-bbl.-per-day or 340 per cent greater current rate, and an indicated increase in recovery of 18.5 per cent in final yield based on a 210-million-barrel normal yield, or 25 per cent on the 199 million to date.

Gas Stored in Formation

A not insignificant feature is the volume of gas replaced into and held in the reservoir by the repressuring which will be available later for other uses. In the pool there are approximately 1,078,000 acre-feet of productive formation of 17 per cent porosity, and 71 to 76 per cent present oil and interstitial water saturation. With the average prevailing reservoir temperature of 112° F. and pressure of 50 p.s.i., the gas now in place amounts to 11¼ billion cubic feet.

Possibilities for Water-Drive

In Table 2 are listed, on three bases: (1) Barrels per acre-foot; (2) barrels per acre, and (3) total pool, the sand, fluid saturation and recovery factors that serve to delineate the possible future reserve by artificial water drive. These are based on 22,710 productive acres and an average sand thickness of 47.4 ft. discounted for the sandy shale cap rock and nonproductive portions.

The stake for water-drive application and the importance of its success are clearly apparent, as after gas-drive depletion there will be over 600 million barrels of oil left in the sand, with approximately one-half of that in sight for recovery according to the usual methods of computing such reserves.

Questions as to the permeability, variations in zonal continuities, floodability, water source, etc., arise. On present knowledge, favorable conditions exist. Phillips Petroleum Co., in particular, has conducted a progressive, well-planned, and substantial program to determine the needed data for their properties at various places through the pool. Mostly within the last year, the company has drilled 17 wells for core information. Both rotary and cable coring methods were used, and both aqueous and oil-base coring muds employed. Some spots were found to have exceptionally uniform permeability profiles, on the order of 25 md., others are "zoned," with portions about 250 md., and others lower.

Water Drive at Northwest Edge

Actual proof of the floodability of the Burbank sand is present in the northwest edge of the pool. The small water influx here has very gradually swept inward two to five locations along a length of 3 miles, and recoveries have been two to five times those of comparable nonflooded territory. Presently, wells along the water-oil front, which were producing from 5 to 20 bbl. per day, are now making 75 to 180 bbl. per day.

Problems Pertaining to Water-Drive Application

One principal problem in considering artificial water-drive projects is water supply; at North Burbank the Arkansas River, together with the extensive sand basin and shallow water-bearing formations in the drainage valley, possibly may provide a good, large-capacity source. The river is about 10 miles from the northwestern part of the pool.

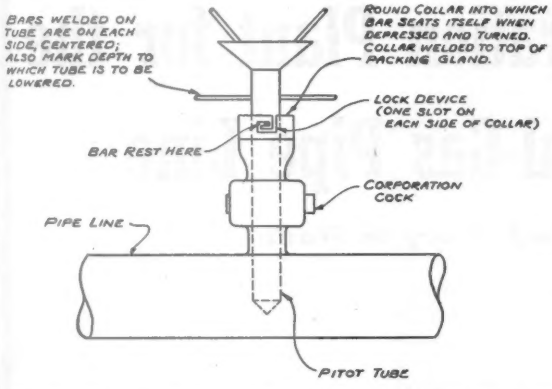
Considerable coring, electrical logging, etc., will be necessary in scrutinizing specific leases for detailed study. At Burbank, with depth of 2,900 ft., serious flushing of cores has been found to occur, and exact determination of interstitial water content to reconstruct fluid contents by using oil-base muds in coring, as well as other procedures, must be employed. Many factors, such as optimum well spacing and pattern arrangement, will require detailed study. For example, in Fig. 4 are illustrated two possible well-spacing programs for such projects. In one, half of the present 10-acre wells could be redrilled or the present ones reworked (possibly by whipstocking and drilling new sand faces) to yield a water-to-oil-well spacing of 660 ft. In contrast, the drilling of new input wells between the present producers would obtain water-to-oil spacing of 467 ft.

All oil-and-gas-producing operations in the North Burbank pool, as elsewhere in Osage County, are supervised by the Osage Agency of the Indian Field Service, U. S. Department of the Interior. Definite regulations and field rules are prescribed. T. B. Hall is superintendent of the agency; E. C. Arnold, supervisor of oil and gas, and J. W. P. Hall, gas engineer.

PLANT PRACTICES

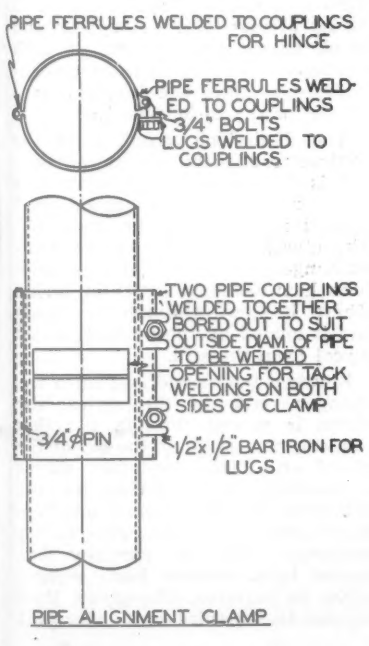
Positioning Pitot Tubes

WHEN the pitot tubes are used for measuring the flow in large water lines, the line pressure may force the tube out of position or even out of the line. To prevent the tube from moving, a locking device

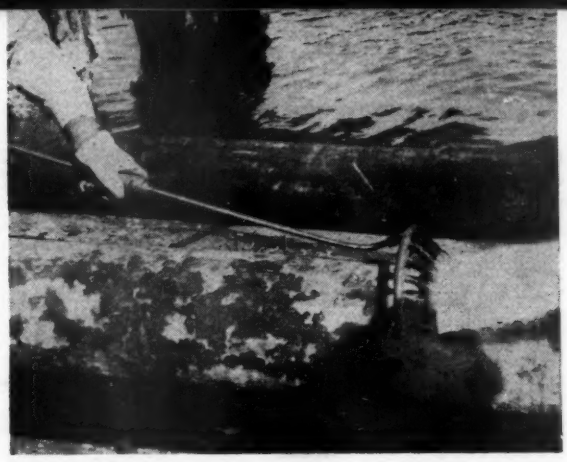

BARS WELDED ON TUBE, ARE ON EACH SIDE, CENTERED; ALSO MARK DEPTH TO WHICH TUBE IS TO BE LOWERED.
ROUND COLLAR INTO WHICH BAR SEATS ITSELF WHEN DEPRESSED AND TURNED. COLLAR WELDED TO TOP OF PACKING GLAND.
LOCK DEVICE (ONE SLOT ON EACH SIDE OF COLLAR)
BAR REST HERE
CORPORATION COCK
PIPE LINE
PITOT TUBE

was installed on top of the packing gland as shown in the sketch. In addition to preventing the tube from moving, the locking device assures that the tube is positioned to the correct depth in the line.

Convenient Aid in Welding


PIPE FERRULES WELDED TO COUPLINGS FOR HINGE
PIPE FERRULES WELDED TO COUPLINGS
3/4" BOLTS
LUGS WELDED TO COUPLINGS
TWO PIPE COUPLINGS WELDED TOGETHER BORED OUT TO SUIT OUTSIDE DIAM. OF PIPE TO BE WELDED
OPENING FOR TACK WELDING ON BOTH SIDES OF CLAMP
3/4" ⌀ PIN
1/2" x 1/2" BAR IRON FOR LUGS
PIPE ALIGNMENT CLAMP

A SIMPLE method for holding the ends of two pieces of pipe in alignment to permit welding is accomplished by use of the clamp shown in the sketch. The device is made from a pair of wide pipe clamps or pipe couplings welded together bored out to fit the pipe and hinged on one side. A slot on each side of the clamp permits tack welding the sections of the pipe after it is pulled into alignment by tightening the toggle bolts.

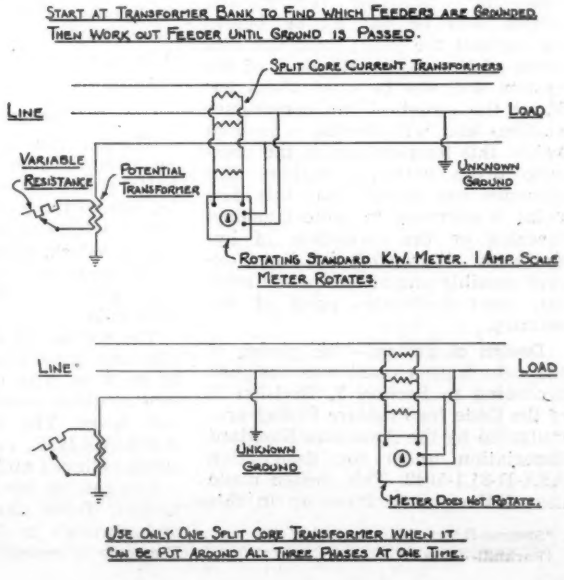


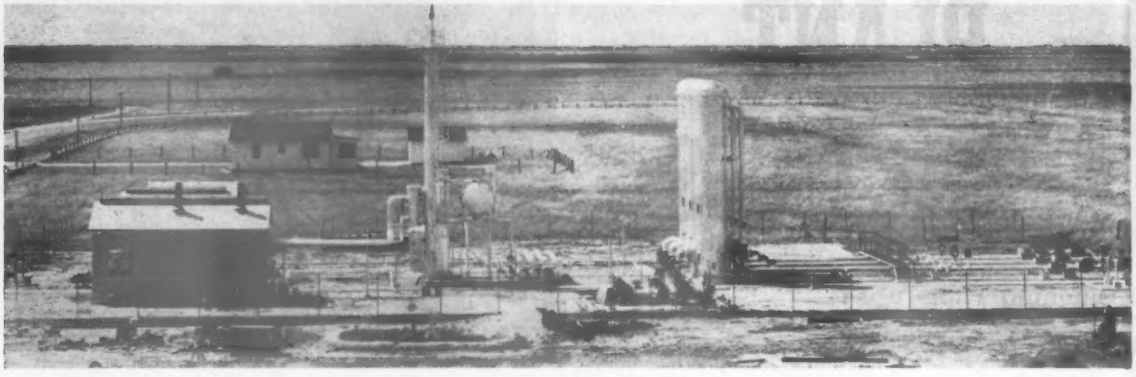
Pipe-Cleaning Tool

A HANDY tool for cleaning pipe surfaces using oxy-acetylene flames consists of a length of curved pipe to the middle of which is attached a threaded nipple of ¼ to ½-in. diameter. A handle is fitted to the curved pipe by means of the nipple. A wood hand-grip is fitted around this pipe at a convenient distance from the curved pipe. To the end of the handle is fitted a mixing assembly connected in the regular way to an oxyacetylene supply through the customery two hoses. To the curved pipe are welded any desired number of burners, fitted with nozzles throwing flat flames, and arranged as a segment of the frustum of a cone. The device, with flames adjusted as desired, is passed over the surface of the pipe to be cleaned, and the pipe heated until foreign matter which is combustible is removed. J. H. Rosson, special welder for Humble Pipe Line Co., was given an award for this idea.

Locating Grounds in Electric Circuit

THE two sketches illustrate a method that can be used for locating grounds in an electric circuit without shutting off the power. The test equipment consists of one or more split core transformers and a standard rotating kilowatt meter. To locate a ground the test equipment is placed immediately after the transformer bank to determine the feeder in which the ground exists. It is then moved along the line until the kilowatt meter stops rotating, which condition indicates that the location of the ground has been passed.


START AT TRANSFORMER BANK TO FIND WHICH FEEDERS ARE GROUNDED. THEN WORK OUT FEEDER UNTIL GROUND IS PASSED.
SPLIT CORE CURRENT TRANSFORMERS
LINE
LOAD
VARIABLE RESISTANCE
POTENTIAL TRANSFORMER
UNKNOWN GROUND
ROTATING STANDARD K.W. METER. 1 AMP. SCALE METER ROTATES.
LINE
LOAD
UNKNOWN GROUND
METER DOES NOT ROTATE.
USE ONLY ONE SPLIT CORE TRANSFORMER WHEN IT CAN BE PUT AROUND ALL THREE PHASES AT ONE TIME.



Over-all view of Tennessee Gas & Transmission Co.'s dehydration plant

Design of the Dehydration Plant for the Tennessee Natural-Gas Pipe Line

by Harold F. Dawe* and Henry N. Wade†

THE dehydration plant at the western end of Tennessee Gas & Transmission Co.'s 1,265-mile 24-in. and 20-in. line is located approximately 5 miles west of Driscoll, Tex., where all gas is processed before being transported.

The gas entering into the pipe line is dehydrated by passing through a diethylene glycol unit. This unit is designed for a working pressure of 840 lb. and will handle a maximum of 300,000,000 cu. ft. of gas per 24 hours. The plant is designed to depress the dew point of the gas processed about 50° F., below the incoming temperature, which will be 80° F., or below, throughout the year; thus, the dew point of the gas in all parts of the system will not be over about 30° F. at the outlet of the compressor stations and will decline somewhat below this temperature as the pressure drops between stations. Experience has shown that this dew point is adequate to protect against freezing or the formation of hydrates on all transmission lines, except possibly one or two of the coldest, most northerly, parts of the country.

Design of piping.—The piping at the dehydration plant was designed according to Section 3, Division 2, of the Code for Pressure Piping promulgated by the American Standard Association under the designation ASA-B-31.1-1942. This design made use of the standard set up in this section for oil and gas piping inside refinery limits.

*Stearns-Roger Manufacturing Co.
†Parkhill-Wade.

This is the third and final installment of a comprehensive article on the design of station and plant equipment for the new Tennessee line. In the issues of November 4 and 11, features of the compressor stations were discussed.

The gas enters the dehydration plant through an 18-in. pipe-line reduced from 900 lb. to 840 lb. through 8-in. pressure reducing regulators, in duplicate. Each regulator is designed to handle 225,000,000 cu. ft. per 24 hours, with a 35-lb. pressure drop. A bypass cuts out one, or both, of the regulators.

Contactor Units

The gas from the regulators enters an 18-in. header and flows into a battery of three contactors in parallel, where the gas is intimately contacted with concentrated diethylene glycol, which, being hygroscopic, absorbs moisture present in the natural gas, and, thus depresses the dew point.

The contactors are 78 in. in diameter and have a net shell length of 31 ft. 6 in. The units each contain two scrubber sections and four contact trays. The contactors are of A.P.I.-A.S.M.E. code design, fully stress relieved and X-rayed.

The gas, on leaving the three contactors, flows through 12-in. pipe and through a 12-in. meter run. There is a recording flow meter on each run and a recording thermometer installed on two of the three runs. The recording thermometers are so arranged that one unit covers two runs for check purposes.

The gas leaving the meter runs is conducted through a header to a duplicate regulator setting where the pressure is reduced from 825 p.s.i.g to 750 p.s.i.g through either or both of two 8-in. pressure reducing regulators in parallel. Each regulator is designed to handle 300,000,000 cu. ft. of gas per 24 hours at 75 p.s.i.g. pressure drop. A bypass and block valves cut out one or both regulators. The gas from these regulators constitutes the supply source of gas for the 24-in. pipe line.

The diethylene glycol from the contactors, slightly diluted with water, is drained from the contactors into a return line by a liquid level control mounted on the contactor. The glycol then flows to the heat-exchange system, of seven shell-and-tube heat-exchange units in series, where it flows through the tubes and is heated by the reconcentrated glycol from the still.

Between the second and third exchanger units in the series, the glycol is passed through a reflux condenser mounted on the top of the glycol still. This condenser serves to condense water reflux for the still from the water vapor, and further heats the glycol. This reflux condenser may be partially bypassed by a vernier hand control valve, as required. The glycol then returns to the third exchanger unit

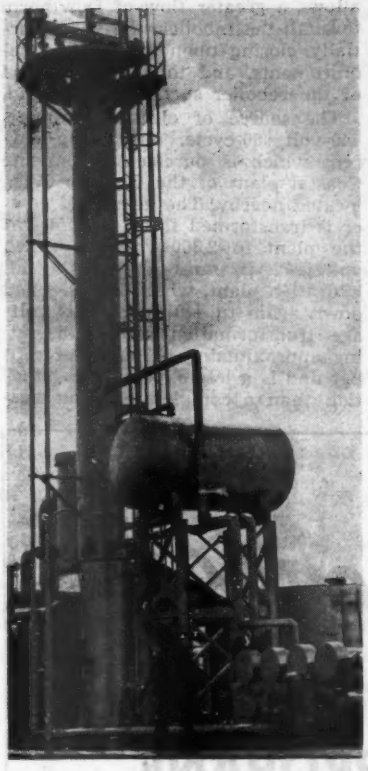
and flows through the remaining units, extracting additional heat from the lean glycol until it finally enters the glycol-still feed tray.

The glycol still is 30 in. in diameter and has a net shell length of 32 ft. 6 in., with a 10-ft. skirt. The vessel has 15 bubble trays. The vessel is designed for a working pressure of 50 p.s.i.g. and is equipped with a safety ladder leading to the platform and condenser support at the top.

Glycol Reboiler

A chordal weir baffle in the still serves to keep the glycol reboiler flooded over the level of the tubes, maintaining heating at maximum efficiency. The reboiler is of the vertical type and connects to the still by 12-in. top and bottom nozzles. It is 24 in. in diameter and has a net shell length of 6 ft. 10 in. The shell thickness is ¼ in. There are 454 ¾-in. 16-gage tubes 48 in. long installed between two tube sheets presenting an internal transfer surface of approximately 300 sq. ft. The reboiler is designed for 50 p.s.i.g. working pressure at a temperature of 550° F.

The lean glycol flowing from the base of the still enters a 60-in. diameter surge tank having a net shell length of 8 ft. This vessel is mounted horizontally to make the maximum use of the tank surge space. This vessel serves to maintain an even head on the lean glycol through the heat exchangers, and to the suction of the glycol pump. It also acts as



Closeup view of the glycol still in the dehydration plant

reservoir, or surge space, for the entire solution-circulating system.

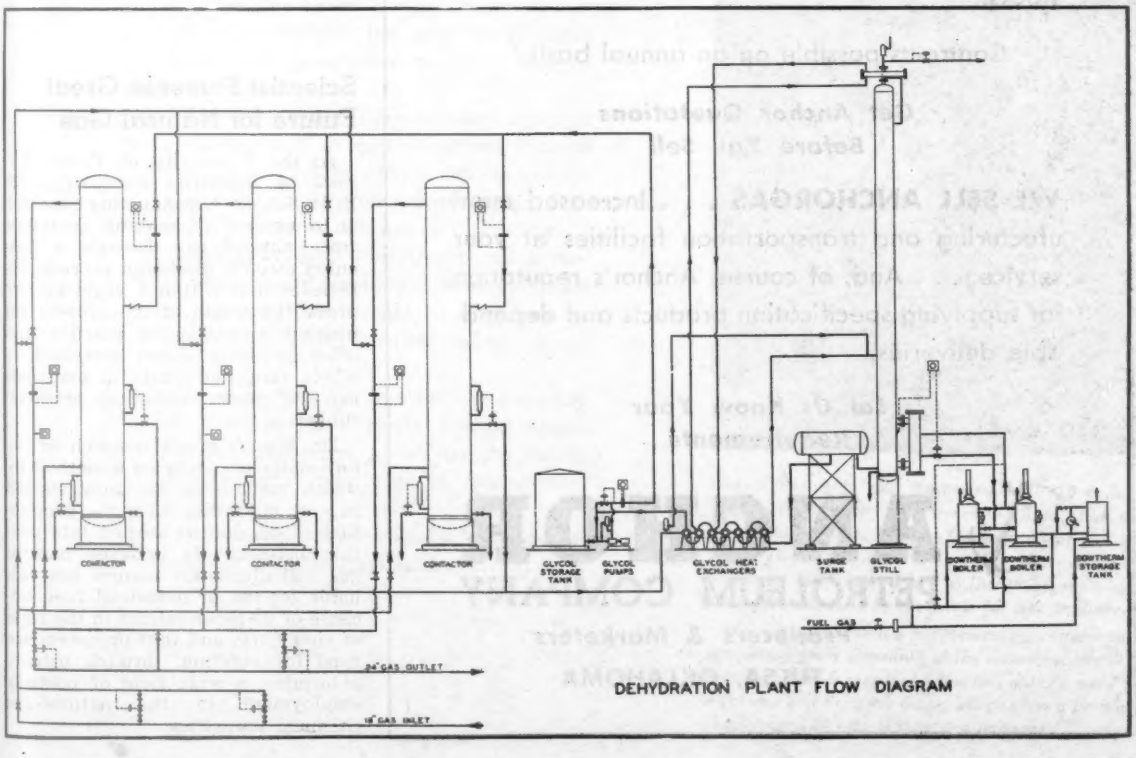
The lean glycol, after passing through the heat exchangers, is pumped back over the contactors. The pump used for this service is a 3¾-in. by 5-in. Union triplex plunger type, driven by a 40-hp. 440-volt 60-cycle open-frame electric motor, with a complete spare unit.

This pump forces the lean glycol through a 3-in. discharge line to the contactors. The lean glycol flows through a flow recorder controller which records the exact total flow of glycol to the contactors. Also, on low glycol flow or failure, the controller operates an alarm whistle which warns the operator. From this point, the glycol flow is split over each contactor by means of an indicating flow meter with manual throttle valve.

For heating the glycol, there are installed two Dowtherm vapor generators. Each of these generators has a capacity of 1,000,000 B.t.u. per hour, and is capable of maintaining the total plant heating load for a short period. However, the plant design anticipates the use of both generators in parallel under normal conditions.

Control Equipment

These generators are equipped with safety valves, low-level warning controls, and with pressure controls. The low-level control is connected to sound a warning signal on low-liquid level. The pressure-control switch cuts off the gas to the main burners when the desired pressure is reached, but leaves the pilots



DEHYDRATION PLANT FLOW DIAGRAM

burning. Upon complete gas failure, the pilot valves close, which are normally energized by an electric current generated through the heat of the pilot. The source of energy for the electric controls is a 6-volt heavy-duty storage battery. This energy source has been chosen as most reliable and is independent of power failure to the plant.

To control the base temperature of the still, there is installed a recording-temperature controller with thermo bulb in the still base. The controller operates a throttling-type diaphragm valve in the Dowtherm return line to the boiler. Where the reboiler must supply more heat to the still base, the valve opens and allows a greater flow of Dowtherm through the reboiler, the valve partially closing upon lower heat requirements, and thus flooding part of the reboiler surface with liquid.

The source of electric power is 440-volt, 60-cycle, alternating current which is purchased from the Coastal plant of the Chicago Corp. located nearby. The generated power is transformed from 440 volts at the plant to 2,300 volts at which voltage it is transmitted to the dehydration plant, where it is stepped down again to 440 volts. This voltage transformation results in saving approximately 4,700 lb. of copper and is a less expensive installation than a complete 440-volt system. The 440-volt power enters the boiler building switchboard where it is metered and is distributed to the points of utilization. The switchboard is a completely unitized control center of the totally enclosed type.

A recording calorimeter and gravitometer are housed in a specially constructed room of the office building. The room has fully insulated walls and ceilings and has double windows. Doors giving entrance to the room slide rather than swing, thus creating less air disturbance. The calorimeter is used to determine and record permanently, in B.t.u., the calorific value of the gas entering the pipe line. The instrument gives results direct in B.t.u. per cubic foot of gas at 30 in. of mercury pressure and 60° F. saturated without any manual operation, computation, or correction of any kind.

The recording gravitometer gives an accurate permanent record of the gas going into the pipe line. For many years it was the common practice to test the gravity of gas sold at periodic intervals and use the value obtained to predict the orifice coefficient for orifice - delivery meters for the ensuing period. The changing gravity requires a constant record in order to make an accurate measurement of the gas, and this instrument provides such.

All fuel used in the operation of the dehydration plant is metered through a dual installation of displacement meters and regulators, adequately safeguarded by pressure-relief valves.

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Scientist Foresees Great Future for Natural Gas

At the University of Texas' bureau of industrial chemistry, Dr. E. P. Schoch is conducting research on a process of making acetylene from natural gas through a patented electric discharge process. He believes that within 3 years he can prove the worth of the process for making materials for plastics and other products. From acetylene, a whole range of synthetic materials can be made, including artificial rubber.

Dr. Schoch hopes research at the university will develop a method by which casinghead gas, now wasted in vast quantities with the production of oil, can be turned into useful channels. He believes natural gas will ultimately become too valuable for use as industrial fuel, because of its potentialities in the field of chemistry, and that prospects are good for creating, through private enterprise, a wide field of postwar employment in the natural-gas chemical industries.

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Shown above is the AMERICAN *500-B Ironcase equipped with our Base Pressure Index. The latter gives a totalized reading of the quantity of gas which passes through the meter in cubic feet (at the base pressure). Each cubic foot (at line pressure) is multiplied automatically by the factor for line pressure.*

It is equipped with a supplementary counter in the rear which gives a reading of the actual volume at line pressure. This is required when this index is used with a Volume and Pressure Gage, which gives a permanent chart record of rate of flow and pressure.

Separability Characteristics of Lubricating Greases

*by T. G. Roehner and R. C. Robinson**

This test method for determining the separation properties of greases has been developed so that it seems a good control apparatus in grease manufacture. Separation of oil from soap under pressure is determined as a filtering action; therefore fritted glass plates were adopted instead of automatic cups which gave poor reproducibility. The separability of oil in greases increases inversely as the viscosity of the mineral oil. The effect of structure of the soap content of greases on separability is also discussed here. This article was presented as a paper before the recent meeting of the National Lubricating Grease Institute at Chicago.

MOST devices employed to apply lubricating greases to bearings utilize pressure to control rate of flow. Their stability under pressure may therefore be of considerable practical importance. Separation of the mineral oil from greases, while in greasing appliances, may lead to concentration of the soap content to the point where the devices become clogged, and feed of new lubricant to the bearings is hindered or prevented. There is no method which is generally accepted for evaluating lubricating greases in this respect. Herschel[1] proposed a method which involved a press in which the grease sample was placed between disks of blotting and filter paper and the loss in weight of the sandwich was reported as the separation. Farrington and Humphreys[2] adopted that method for their study of the subject. The objective of this report is to outline another procedure and summarize the results obtained therewith. The tester is shown in Fig. 1. The steps which preceded adoption of that design may be briefly summarized as follows:

1. Tests in series of three well-known commercial automatic cups showed that interlaboratory reproducibility was poor. The cups were not suitable for use in laboratory equipment because spring pressures varied appreciably and the pistons had a tendency to stick.

2. It was determined that even under favorable conditions, the tests using automatic cups were not only an evaluation of separability characteristics of the greases but were also an indication of variations of the clearances of the pistons.

3. It was found that pressure alone caused no important separation of the greases. Application of over 3,000 p.s.i. resulted in no appreciable separation of oil from greases which, when placed in automatic cups at pressures less than 10 p.s.i., lost more than 25 per cent of their mineral-oil component during the same time interval and at the same temperature range.

4. It was concluded that separation in the cups was largely due to a filtering action and, therefore, the adoption of fritted glass plates in place of automatic cups was advisable because they are obtainable with a high degree of uniformity and may be accurately calibrated.

The test procedure developed is the following: The burette, the connecting tube, and the funnel are filled with mineral oil so that the level of the oil in the burette is even with that of the filter plate. The oil used wherever possible is the same as that employed in the manufacture of the grease under test. Otherwise the oil is selected so that it has practically the same viscosity as that in the grease at the test temperature. After wiping any excess oil from the top of the filter plate, 150 grams of the grease are placed in the funnel and the yoke is made airtight by means of the connecting screws. The valves on the air reservoir, which maintains a constant pressure, are then opened. As the oil separates from the sample through the filter plate, its volume is read directly from the burette. The tests are run in a constant temperature room or equivalent.

Using the fritted glass plates with pores of 5-10 microns, the extent of the agreement between the tester and the corresponding setup employing a series of automatic grease cups, is shown in Table 1.

The reproducibility of runs made in the tester is shown by the data given in Table 2.

The variation found in the three runs is believed to be well within

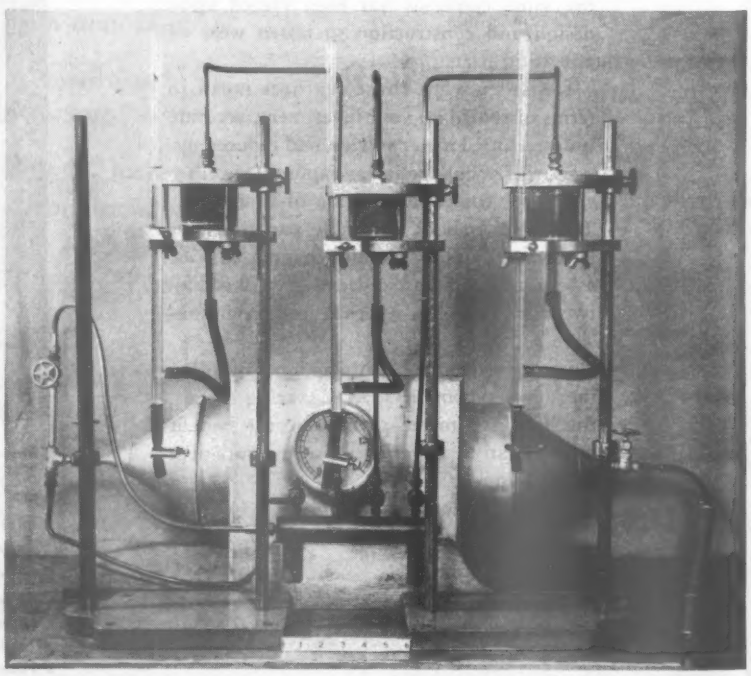


Fig. 1: Grease-separability-test apparatus

*Socony-Vacuum Oil Co., Inc.

TABLE 1
Automatic Grease Cup vs. Separability Tester 7.5 Lb./Sq. In. Pressure—70° F. Temperature

Conventional cup greases	Total hours tested	Per cent separated oil	
		Cup	Tester
Sample No. 1	168	9.1	8.2
Sample No. 2	168	6.6	7.1
Sample No. 3	72	3.7	4.1
Sample No. 3	168	4.9	5.6
Sample No. 4	168	4.6	4.3

TABLE 2
No. 3 Cup Grease—Reproducibility of Runs in the Separability Tester

	Hours to separate		
	5% oil	10% oil	15% oil
Run 1	52	188	337
Run 2	57	197	355
Run 3	58	200	370

the range having practical significance.

Determining Factors

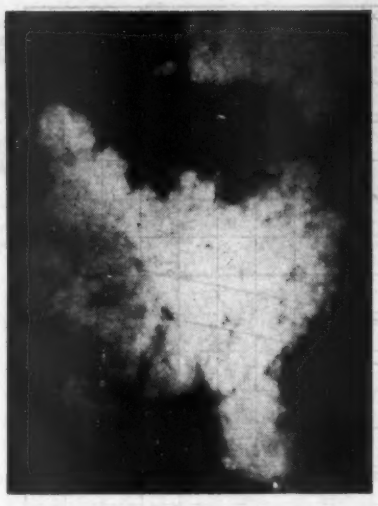
Experience has demonstrated that although the above test procedure was primarily intended to rate the products in respect to their comparative pressure stabilities in automatic cups, the data also reliably indicate the relative tendencies of the greases to separate oil when subjected to pressures in centralized greasing systems and high pressure guns. A wide variation of greases have been tested and the data show that separability is determined by a number of factors all of which are of the type which affect the rate at which the oil may be filtered from the grease.

1. Structure.
2. Percentage of soap.
3. Viscosity of mineral oil.
4. Time.
5. Pressure.
6. Design of retaining agency.

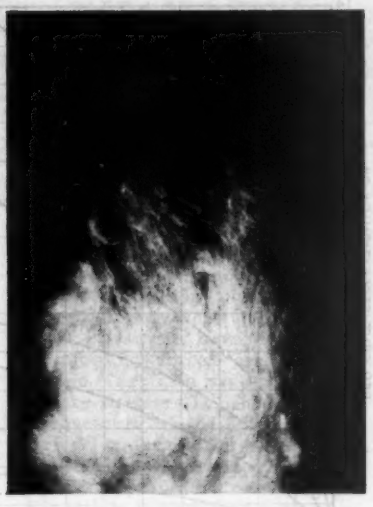
The structures of greases are determined primarily by the type of soap, by the presence of additives as for example petrolatum and so-called coupling agents or mutual solvents and by manufacturing procedure. The type of mineral oil may also be a factor in some instances.

The first six products listed in Table 3 are conventional greases containing no additives. The two sodium-base greases differ in the type of fatty material employed for making the soap. The short-fibered calcium-base product is not conventional in that it is not an emulsion of water-in-oil and is made with a novel combination of calcium soaps and a coupling agent or mutual solvent. The wide variation in structure of the soaps present in the seven samples may be illustrated by photomicrographs (Fig. 2). Grease No. 4 has the typical gel structure of aluminum-base products while greases Nos. 3 and 6 are water-in-oil emulsions normal for calcium-base cup greases. When greases having conventional formulae are compared, Table 3 indicates that with other factors equal, such as percentage of soap and viscosity of mineral oil, lithium-base products tend to be the least stable and aluminum-base greases the most most stable in respect to separation under the subject test conditions.

The consistency of greases is normally controlled by varying the percentage of soap. However, there are products the A.S.T.M. penetrations of which are the result more of the degree of working which they receive during manufacture than control of their soap contents. The effect of variations in concentrations of soap on separability may be illustrated by data (Table 4) obtained from tests of a line of conventional

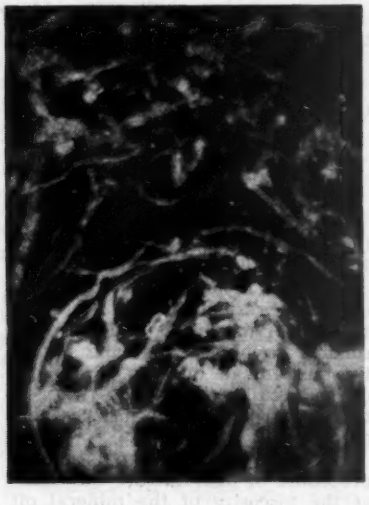


Grease No. 1: Dense mass, no fibrous structure evident



Grease No. 7: Fine uniform mass of hair-like appearing fibers

Grease No. 2: Long tough relatively coarse fibrous structure



Grease No. 5: Long definite fiber structure but not tough

Fig. 2: Structure of soap present in greases referred to in Table 3. Magnification 150X. Dark field illumination

TABLE 3—EFFECT OF TYPE OF SOAP ON OIL LOSS

No.	Type	Grease structure	A.S.T.M. worked penetration	Hours to separate 5% oil	10% oil	25% oil
		Mineral Oil Component—S. U. Visc. at 100° F.—105 Sec.				
1	Lithium	Buttery	255	3	8	21
2	Sodium	Tough-Fibrous	296	4	11	41
3	Calcium	Buttery	305	10	34	184
4	Aluminum	Smooth gel	313	17	62	319
		Mineral Oil Component—S. U. Visc. at 100° F.—285 Sec.				
5	Sodium	Short fiber	308	6	16	60
6	Calcium	Buttery	315	22	69	288
7	Calcium	Short fiber	335	97	420	+1,000

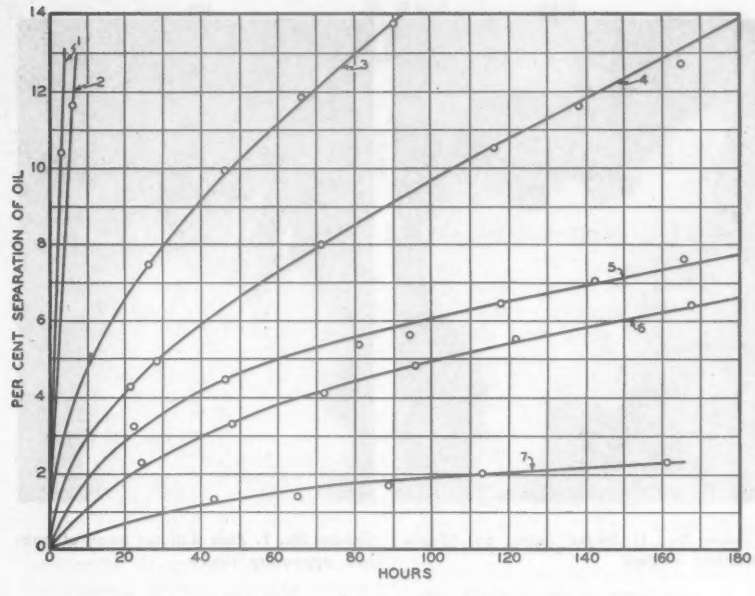


Fig. 3: Chart illustrating form of curves obtained for greases reported on

TABLE 4—EFFECT OF PERCENTAGE OF SOAP

Calcium soap	A.S.T.M. worked penetration	Hours to separate 5% oil	10% oil	25% oil
10.6%	357	6	18	100
11.5%	305	10	34	184
16.8%	254	13	47	272
20.2%	200	47	185	+400

lime base cup greases made with a 105 sec. at 100° F. viscosity pale oil.

The soap is normally the component most responsible for the consistency of the grease and it is reasonable to expect that the higher the percentage of soap, the more difficult will it become to filter oil therefrom, particularly in large percentages.

For a given type soap base and procedure of manufacture the lighter the viscosity of the mineral oil component, the greater will be the rate of separation of oil. This may be illustrated by referring to Table 5 showing the results of tests of a series of conventional cup greases made with the same calcium soap base.

TABLE 5—EFFECT OF VISCOSITY OF MINERAL OIL COMPONENT

S.U. visc. at 100° F.	% soap	A.S.T.M. worked penetration	Hours to separate 5% oil	10% oil
850 sec.	15.0	255	95	245
500 sec.	16.5	257	40	135
285 sec.	15.5	262	24	103
105 sec.	16.8	254	13	47

It is a truism to state that the viscosity of mineral oil varies with temperature. The structure of the grease may also undergo important changes, particularly if the temperatures pass through certain critical ranges. Table 6 illustrates the effect which an increase in test temperature from 70° F. to 130° F. had on three particular products.

TABLE 6—EFFECT OF TEMPERATURE

Sample	70° F. 1 day	4 days	7 days	130° F. 1 day	2 days
No. 1	2.6	5.9	8.0	8.4	11.3
No. 2	1.5	3.4	4.5	3.0	5.0
No. 3	10.0*	..	..	11.5†	..

*After 8 hours. †After 7½ hours.

Sample No. 1 is a conventional lime-base cup grease made with an oil having a S. U. viscosity of 850 sec. at 100° F. The second sample is a novel type of lime-base grease containing an oil with a viscosity of 285 seconds at 100° F. Sample No. 3 is a lithium-base product made with a 75-sec. at 100° F. viscosity oil. It may be of interest to note the extent to which separation of oil changed the concentration of soap in the top and bottom portions of the samples as they were removed from the tester after the runs at 130° F.

Sample	Per cent saponified fat Before test	After test Top	Bottom
No. 1	12.9	12.8	20.3
No. 2	10.3	10.0	11.0
No. 3	14.8	18.2	23.3

It is obvious that time is a factor determining the amounts of oil that will be separated from the greases in the tester. The following data were taken from runs which were continued for 1,000 hours.

TABLE 7—EFFECT OF TIME

Sample	A.S.T.M. worked penetration	Per cent oil separation 200 hrs.	500 hrs.	1,000 hrs.
A	304	8.3	13.8	19.2
B	260	6.6	10.6	15.0

Samples A and B are conventional lime-base cup greases made with an oil having a S.U. viscosity of 850 sec. at 100° F. When the curves were plotted for those runs it was noted that their slopes still had developed no marked tendency to level or, in other words, the concentrating effect on the soap content of the grease in contact with the filter had still not led to important interference with rate of separation of the oil after 1,000 hours. Fig. 3 illustrates the form of curves obtained for greases of the type mentioned throughout this report. Curves Nos. 1 and 2 are soda-base cup greases containing a 300-second oil. Nos. 3, 4, and 5 are conventional lime-base greases made with oils having viscosities of 100, 285 and 850 seconds, respectfully. No. 6 is a soda-base grease with an oil heavier than 3,000 seconds at 100° F., while No. 7 is a new type of lime-base cup grease containing a 285-second at 100° F. oil.

Similar data could be presented to support the statements made earlier in this report that pressure is an important factor affecting the rate of separation. The design of the retaining agency as, for example, the effective clearance of the piston in the cup, is another variable the importance of which is selfevident.

Pressure is another important variable determining the amount of oil separation under the subject conditions but, as noted earlier in this report, its primary effect is that of promotion of the filtering action. When grease is completely confined, it has been observed that no separation occurs but when the confining agency is so designed that it may function as a filter then oil will be removed from the product as pressure is applied.

To summarize very briefly, separation of oil from grease while under pressure in application devices such as automatic cups, is essentially the outcome of a filtering action. In the rating of greases in terms of their separability characteristics under those conditions, it is advisable to recognize that there are a number of factors involved. Selection of the grease on the basis of type of soap base above may not be sufficient to insure the desired stability.

References

1. W. H. Herschel, Proc. Am. Soc. Testing Materials 33 P. & I., 343-7 (1933).
2. B. B. Farrington and R. L. Humphreys, Ind. Eng. Chem. 31, 230-5 (1930).

William C. Chonette, who was chief engineer in the exploitation department of Shell Oil Co., Inc., in the Los Angeles headquarter, has been made manager of Canadian operations, with offices in Los Angeles. **Joseph E. Flacy,** who was head roustabout at Bakersfield, has been advanced to foreman of construction and maintenance of Shell's San Joaquin division with offices in Bakersfield.

Interstitial Water, Gravity, And Capillary Pressure

Mechanics of Producing Oil, Condensate, and Natural Gas

*by Park J. Jones**

PART 4 OF A SERIES

Reservoirs contain interstitial water. But some reservoirs contain more water than others. The cause of the variation is probably a combination of several factors such as surface area, size of voids, number of voids per acre foot and molecular attractions. In production, molecular attractions are implied in such phrases as surface phenomena, capillarity and capillary pressure.

Gravity would probably displace more of the water found in reservoirs if there were no opposing forces. Physicists have found that the opposing forces are capillary pressure. They also have shown that capillary pressure is proportional to the curvature of the interfaces between (1) water and reservoir liquid; (2) water and reservoir gas, and (3) reservoir liquid and reservoir gas.

Fig. 4-1 is intended as a diagrammatic illustration of interfacial curvature and interstitial water. The gray areas represent particles; the black, interstitial water; and the white, a reservoir fluid.

THE attraction between like molecules is called cohesion The attraction between unlike molecules is called adhesion. A molecule withing the body of a liquid is attracted on all sides by other molecules. The attraction is the same in all directions. But a molecule on the surface of a liquid is not surrounded by liquid molecules. So the attraction on a surface layer of molecules is unbalanced. This unbalanced attraction causes the surface of a liquid to behave as if it were an elastic membrane in tension. Such behavior is called (1) surface tension for liquid-gas interfaces and (2) interfacial tension for liquid-liquid interfaces. Surface and interfacial tensions are in part responsible for the phenomenon called capillary pressure.

Surface and interfacial tensions are expressed in pounds per inch or, more commonly, in dynes per centimeter. A pound/inch equals 175,000 dynes/cm. Three types of interfaces may exist in reservoirs. Those between (1) water and reservoir liquid, (2) water and reservoir gas, and (3) reservoir liquid and reservoir gas. Within the range of the conditions existing in reservoirs as to pressure, temperature and composition of fluids, the magnitude of surface forces is highest for water-gas interfaces, intermediate for water-liquid interfaces and least for liquid-gas interfaces.

TABLE 4-1—SURFACE TENSION FOR WATER AGAINST GAS
(Data by Hocott)

Pressure (p.s.i.)	Surface tension, dynes/cm. 78° F.	150° F.
0	74.1	67.5
100	71.1	63.2
250	66.5	58.8
500	61.6	55.5
1,000	55.9	50.4
1,500	51.6	46.5
2,000	47.9	42.3
2,700	44.1	39.5
3,000	42.2	37.4
3,500	40.3	36.0

*Production consultant, Houston.

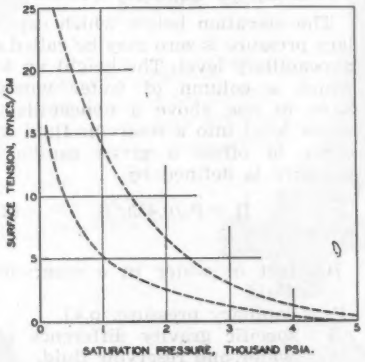


Fig. 4-2: Showing probable limits of surface tension for liquid-gas interfaces in reservoirs. After Katz, Monroe, and Trainer

Table 4-1 shows the surface tension observed by Hocott for water against reservoir gas. Table 4-2 shows the interfacial tension observed by Hocott for water against the reservoir liquids found at Anahuac, Conroe, and K.M.A., respectively. Fig. 4-2 shows the range and probable limits of surface tension to be found in most reservoirs for saturated reservoir liquids against reservoir gases and displacement gas. The curves in Fig. 4-2 are based on the work of Katz, Monroe and Trainer. The surface tension of a saturated reservoir liquid against a gas approaches zero at high pressures.

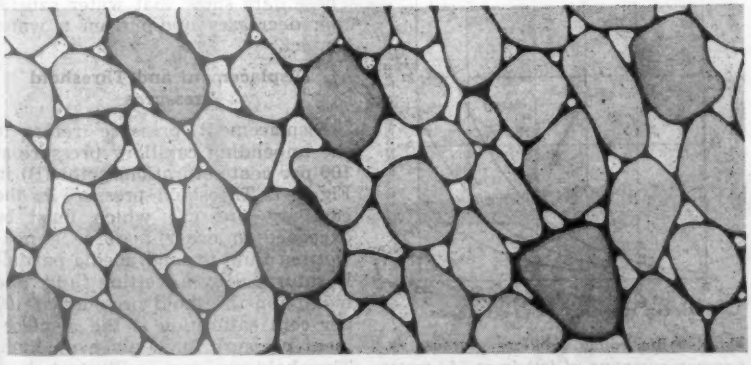


Fig. 4-1: Illustrating interstitial water in interfacial curvature

TABLE 4-2—INTERFACIAL TENSION FOR WATER AGAINST RESERVOIR LIQUID
(Data by Hocott)

Anahuac: 178° F.		Conroe: 170° F.		K.M.A.: 130° F.	
P.s.i.	Dynes/cm.	P.s.i.	Dynes/cm.	P.s.i.	Dynes/cm.
3,800	30.5	3,700	30.6	2,500	34.8
3,500	30.6	3,000	31.2	2,000	35.3
3,150	30.7	2,500	31.7	1,590	36.0
2,580	30.3	2,000	32.6	1,520	35.9
2,050	30.1	1,550	31.5	1,000	35.8
1,540	30.2	1,020	29.5	770	35.7
1,120	30.1	515	27.8	500	35.4
470	29.1	260	26.8	260	34.7
100	27.7	100	25.8	100	33.4
0	27.1	0	25.1	0	31.4
Initial Saturation Pressure, P.s.i.					
3,120		2,035		1,570	
Gas-Oil Ratio at Initial Saturation Pressure, Cu. Ft./Bbl.					
640		550		650	
Oil Gravity, °A.P.I.					
33.5		36.9		41.3	

Degree of Wetting

The nomenclature commonly used in discussing surface phenomena is illustrated in Fig. 4-3. The forces acting at the point of contact of water and a reservoir fluid with a solid are as follows: (1) the surface tension between water and the solid (2) the surface tension between the reservoir fluid and the solid and (3) the interfacial tension between water and the reservoir fluid.

Interface	Sur. tension Lb./in.	Sur. tension Dynes/cm.
Water and reservoir gas	0.00028	40
Water and reservoir liquid	0.00014	20
Reservoir liquid and reservoir gas	0.00007	10

The capillary pressure corresponding to a given average curvature in Fig. 4-4 is higher for a water-gas interface than it is for either of the other two interfaces. This does not mean that there is more water in a gas reservoir than in a liquid reservoir. Gravitational forces must also be considered.

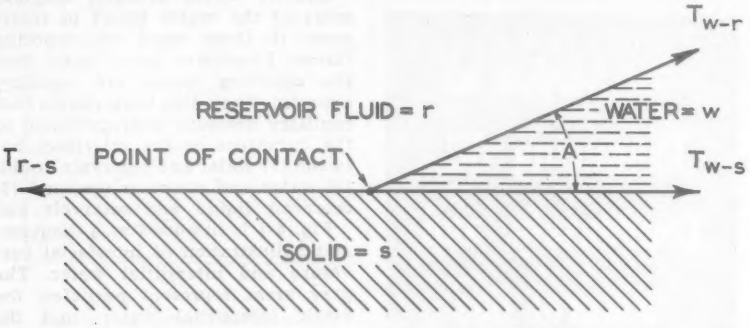


Fig. 4-3: Illustrating the forces at the point of contact of a solid, water, and a reservoir fluid. T_{w-s} and T_{r-s} are surface tensions; T_{w-r} interfacial tension; A is contact angle

Angle A is called the contact angle. The contact angle is acute in water, the wetting fluid. As the contact angle approaches zero, the solid becomes wetted completely. The degree of wetting depends on the composition of the solid and on the properties of water and the reservoir fluid.

For the purposes of this work it is assumed that the media comprising pay are completely wetted by water. The low water saturation found in some reservoirs is, the writer believes, a matter of surface area and size of openings rather than degree of wetting by water.

Capillary Pressure vs. Curvature of Interface

Capillary pressure is the pressure difference across an interface. Physicists have found that capillary pressure or pressure difference across an interface is proportional to surface tension and the average curvature of an interface, that is,

$$P_c = TC \qquad (1)$$

where

P_c — capillary pressure, p.s.i.

T = surface tension, lb./in.

C = average curvature of interface, 1/in.

The curves in Fig. 4-4 are solutions of equation (1) for the three interfaces of interest in production. As the properties of fluids vary from reservoir to reservoir, Fig. 4-4 is only illustrative. The following values of surface tension were used:

Gravity vs. Capillary Pressure

The elevation below which capillary pressure is zero may be called a noncapillary level. The height up to which a column of water would have to rise above a noncapillary water level into a reservoir fluid in order to offset a given capillary pressure is defined by

$$H = P_c/0.433\Delta S \qquad (2)$$

where

H = feet of water in a reservoir fluid

P_c = capillary pressure, p.s.i.

ΔS = specific gravity difference of water and reservoir fluid.

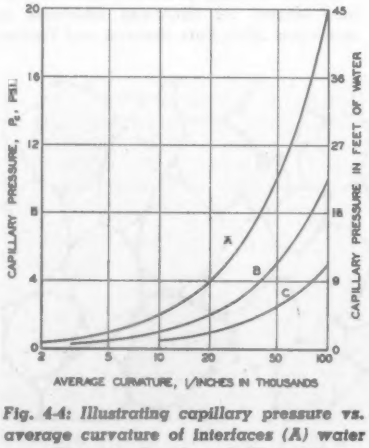


Fig. 4-4: Illustrating capillary pressure vs. average curvature of interfaces (A) water gas, (B) water liquid, and (C) liquid gas

For illustrative purposes let it be assumed that a reservoir gas exerts a pressure of 10 p.s.i./100 ft.; a reservoir liquid, 30 p.s.i./100 ft.; and a reservoir water, 50 p.s.i./100 ft. The corresponding pressure differences are as follows: water-gas, 40 p.s.i./100 ft.; water-liquid, 20 p.s.i./100 ft. In this example, the gravitational forces tending to pull water downdip in a gas reservoir are twice those in a liquid reservoir. Other things equal, gas reservoirs contain less water than liquid reservoirs.

Three conclusions follow from equations (1) and (2). First, water saturation decreases updip from a water contact. Second, capillary pressure increases updip from a water contact. Third, capillary pressure will force some water updip if a water contact rises during the life of a reservoir.

It would be interesting to determine the water saturation and capillary pressure at various levels in a huge core about 100 ft. high. As this does not appear practical, water saturation is measured on small core samples in which capillary pressure is imposed arbitrarily.

Water Saturation vs. Capillary Pressure

A laboratory procedure for reducing water saturation in small core samples by imposing capillary pressure in the sample is as follows: Seat a sample on a thin bed of any fine water-wet substance in a fritted glass filter funnel, seal the funnel and apply pressure with a gas. When the water saturation in the sample is reduced sufficiently, the pressure across the water-gas interfaces in the sample equals the applied pressure, no additional water is displaced and fluids in the sample are said to be in capillary equilibrium.

Figs. 4-5 and 4-6 are reproductions of data on water saturation and capillary pressure obtained by Hassler, Brunner and Deahl. The curves in Fig. 4-5 are for sandstone samples and those in Fig. 4-6, for limestone samples. These are intended as illustration of the variation in water saturation with capillary pressure. These data show that water saturation decreases updip from a water contact.

Displacement and Threshold Pressures

Displacement pressure refers to the impending capillary pressure at 100 per cent saturation, point (B) in Fig. 4-7. Threshold pressure is the capillary pressure which must be exceeded in order to force a nonwetting fluid through media partially saturated by a wetting fluid. The maximum threshold pressure at 100 per cent saturation is the displacement pressure for a given medium. Threshold pressure is illustrated by curve (A) in Fig. 4-7.

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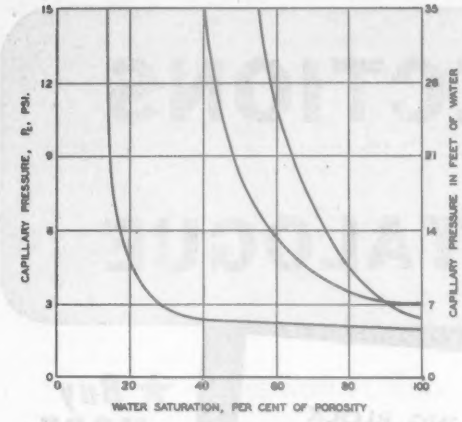

Fig. 4-5: Illustrating water saturation vs. capillary pressure in sandstone samples. Data by Hassler, Brunner, and Deahl

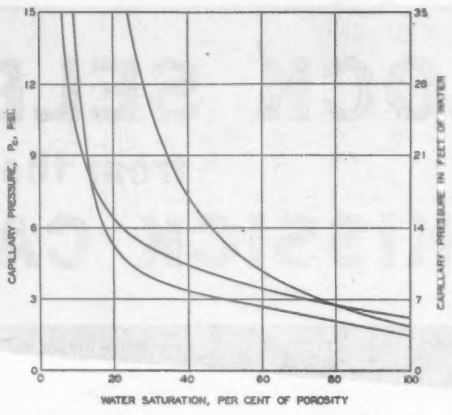

Fig. 4-6: Illustrating water saturation vs. capillary pressure in limestone samples. Data by Hassler, Brunner, and Deahl

Consider a medium containing a number of voids which vary in size. Gas can be forced into the largest openings if the pressure tending to force gas in exceeds the capillary pressure tending to keep gas out. This is the displacement pressure. After gas enters the largest openings, the capillary pressure tending to keep gas out drops down to zero for the largest openings. If the pressure tending to force gas in is equal to or less than the displacement pressure for the largest openings, no gas can be forced into the comparatively smaller openings. In other works, gas will bypass the smaller openings unless the viscous resistance to the displacement of gas through the larger openings exceeds the displacement pressure for the smaller voids.

Water Contact in Liquid Reservoirs

Some reservoirs have bottom water. Many have edge water. A water contact at a given location in a given reservoir is an elevation below which there are negligible quantities of commercially recoverable reservoir fluids. The water contact in a given reservoir is a surface.

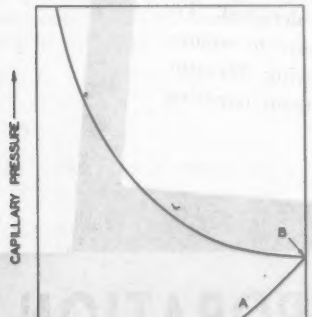

Fig. 4-7: Illustrating (A) threshold pressure, and (B) displacement pressure

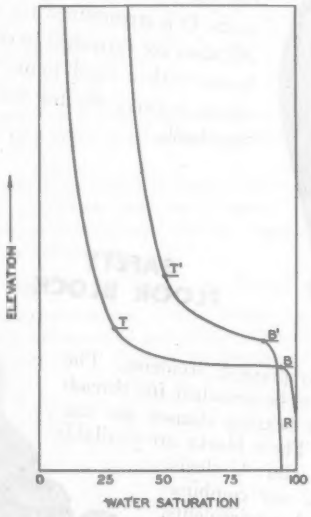

Fig. 4-8: Illustrating water contacts B and B'; zones of transition B-T and B'-T'; and nonrecoverable liquid saturation below water contacts

The surface may be a plane or a warped surface.

The curves in Fig. 4-8 are a diagrammatic illustration of a water contact in a liquid reservoir. Differences in the characteristics of media may account for differences in water contact levels aside from large-scale structural and stratigraphic considerations. Points B and B' in Fig. 4-8 correspond to the elevations usually chosen on electric logs for water contacts.

Field experience indicates that numerous reservoirs contain commercially nonrecoverable reservoir liquids below their water contacts. The region R in Fig. 4-8 illustrates nonrecoverable liquid saturation below a water contact.

Transition Zones

A zone of transition from water to reservoir liquid occurs between two elevations, see Fig. 4-8. The lower limit of a zone of transition is a water contact. The upper limit is an elevation above which only reservoir liquid is producible initially. In the zone of transition itself, reservoir liquid and water are producible initially. As the characteristics of pay vary, the thickness of a transition zone is not necessarily the same throughout a given reservoir. In Fig. 4-8, the vertical distances between BT and B'T' represent zones of transition.

Similar considerations hold for zones of transition from water to reservoir gas and for the zones of transition from reservoir liquid to reservoir gas. As the properties of fluids vary, the thicknesses of water-liquid, water-gas, and liquid-gas transition zones are not equal.

Initial Distribution of Fluids

The distribution of fluids in a liquid reservoir at the time of discovery may be in three regions: (1) The region below a water contact, (2) the region occupied by a zone of transition, and (3) the region above the zone of transition. Liquid reservoirs having a gas cap, not shown in Fig. 4-8, also have a zone of transition from reservoir liquid to reservoir gas.

Referring to Fig. 4-8, the region below a water contact may contain nonrecoverable reservoir liquid. In the zone of transition, water saturation decreases rapidly with elevation until a level is reached above which no water is producible initially. In the region above the zone of transition, water saturation may vary in accordance with the variation of pay characteristics. The procedures for estimating water contacts, gas contacts, and the initial distribution of fluids in reservoirs will be considered in later articles.

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Frank Miller, district clerk for Atlantic Pipe Line Co. in Midland, Tex., has been transferred to the southern headquarters in Dallas.

Front Lines in REFINING

by Arch L. Foster

Hydrocarbon Coefficients Of Expansion

IN earlier chemical engineering history, many near assumptions and some entirely empirical assumptions were necessary in order to permit any intelligent sort of design operations to be carried out. Often the factors of error were large and the safety factors employed were correspondingly large to avoid or minimize difficulties up to disaster. One of these problems has been the coefficients of expansion of hydrocarbon liquids and vapors, especially the more volatile liquids known to and dealt with by the oil industry.

Recently this industry has worried much with light hydrocarbons—ethane, ethylene, propane and propylene, butanes and butenes are all important in making aviation 100-octane-number fuel components, alkylate, cumene, toluene; just as important in styrene, butadiene, acrylonitrile for synthetic rubbers. An appeal for help came from the Macedonia of war products making and the U. S. Bureau of Standards attacked the riddle. It was found that a direct relationship existed between the vapor pressures of these hydrocarbons and their coefficients of expansion; stated in more mathematical terms, "The coefficient of expansion is very nearly a single-valued function of the vapor pressure." Bureau scientists developed a table of correction factors covering hydrocarbons having vapor pressures between 40 lb. and 80 lb. absolute at 100° F. Write the Bureau of Standards about it.

Adsorption Methods for Aromatics Purification

SILICA gel adsorbs 0.10 moles to about 0.16 moles of aromatic hydrocarbons per 100 g. of the adsorbent, according to published information released recently. The Bureau of Standards in attempting to purify mixtures of aromatic hydrocarbons investigated the use of the adsorptive action of various materials, for removing aromatics from mixtures with paraffins, isoparaffins and naphthenes. The system employed, a relatively simple percolation tube arrangement, is claimed to have such advantages as (1) simplicity, (2) quantitative separation can be obtained, and (3) scheme is applicable to material of a wide boiling range.

Not only can different simple hydrocarbons be separated by this method, but polynuclear aromatics, such as naphthalene, anthracene, etc., can be separated from one another. The more complicated molecules, the molecules which contain the greatest number of aromatic nuclei combined linearly, are adsorbed more strongly, and the arrangement of rings determines the order of adsorption. In materials with olefinic units those containing the greater number of olefinic linkages are the more strongly adsorbed. The general method offers a possible solution of many research as well as commercial or industrial problems.

Propellerless, Jet-Driven Planes Need No Warmup

ONE major advantage in the jet-powered plane is that it is ready to take off almost the instant that combustion is started in the engine, General Electric engineers are announcing. G. E. has undertaken the job of equipping jet-propelled planes with gas-turbine engines, and has converted its second largest wartime plant, 600,000 sq. ft. of floor space, to producing the engines and fitting them into planes. Gen. H. H. Arnold, head of military aviation, U.S.A., holds great hopes for this type of plane power in the future, both military and commercial. The planes now being equipped are single-seater, high-altitude fighters, and some expect them to appear in numbers in at least the Japanese division of the war operations.

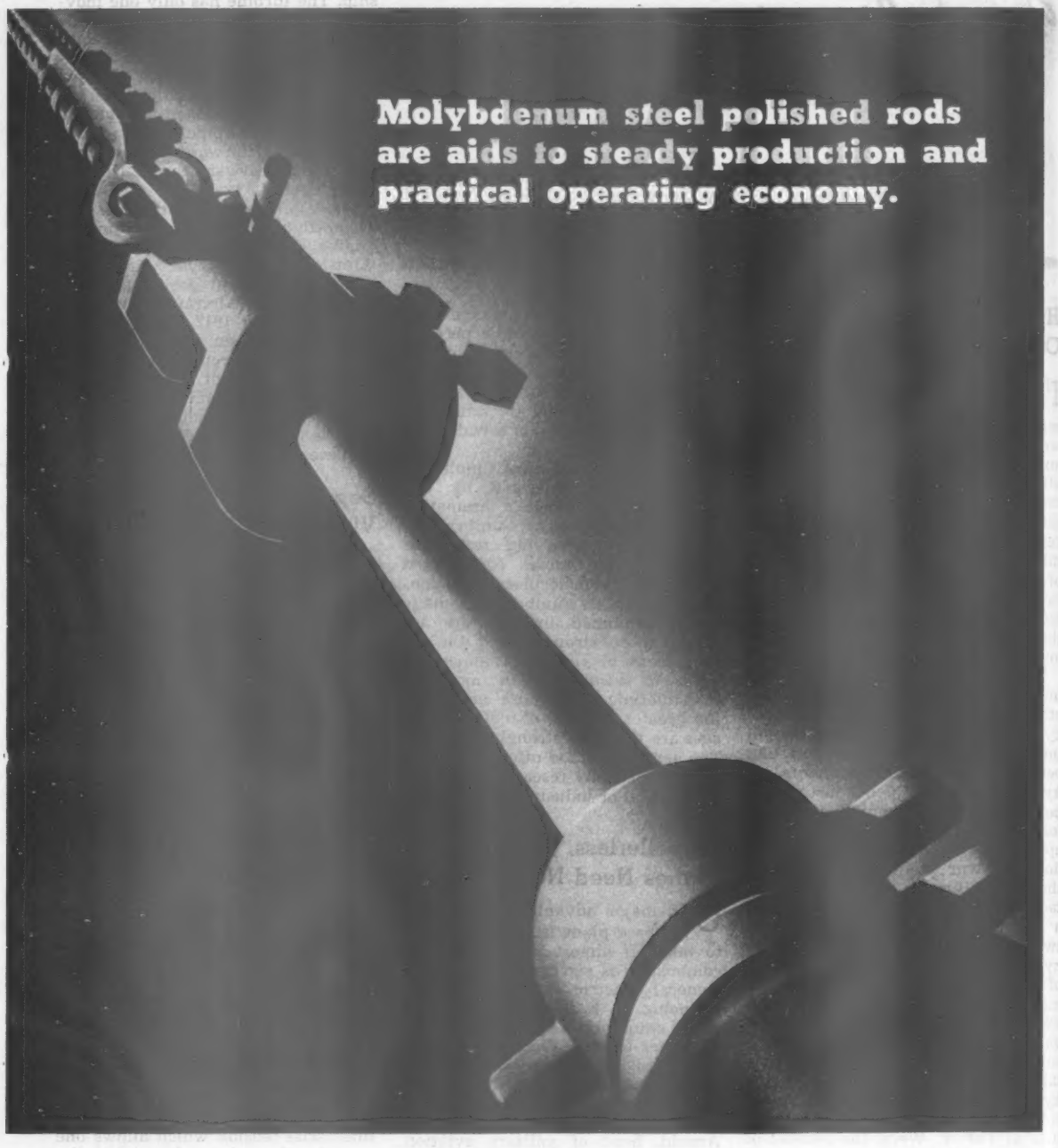
These gas turbines will operate on either kerosene or gasoline, with kerosene having the advantage of lowered fire hazard in case of crash or other disaster. They can take off within 30 seconds of starting, cold, it is stated. No flames show from the exhaust when in operation, thus not giving away the position of the ship. The turbine has only one moving part, it is stated. That is the compressor which takes in and compresses air, sending it into chambers where its temperature is raised rapidly by fuel combustion, the hot gases-air mixture shooting out the rear through tail-pipe nozzles, pushing the plane forward by the reaction to this rearward thrust. No propeller is used.

These jet-propulsion turbines are designed by development from the original design made by Capt. Frank Whittle of the Royal Air Force, England. The first design powered the P59A Bell Aircraft which flew first in October 1942, and strides in design have been long and rapid since then. Apparently high-octane-number fuel is not required at all in these engines, and the expensive processes for production of superfuels as we now know them will not be necessary.

Separation of Liquids Via Porous Media

A NEW-OLD principle has been adapted in small units to the problem of separation of finely divided but immiscible liquids. This principle may be expressed approximately as that of the resistance of the interface between two liquid globules to rupture, as when "stretched" across a pore of some porous medium, a medium which is wetted preferentially by the liquid which is to be eliminated by passing through the medium. Two liquids, such as gasoline and water, are intermixed, and we wish to dry the gasoline. It may be separated from water either by choosing a porous medium which is preferentially wetted by the gasoline, pumping the mixture to and thus forcing the gasoline through the porous medium; or by choosing a medium preferentially wetted by the water and forcing it through the pores of said medium. In either case the particles of the one are prevented from passing through the generally microscopic or submicroscopic pores of a filter medium by the preferential wetting by the other liquid, by the interfacial tension which allows one particle through and rejects the other. Relationship between pore diameter and particle size is also an important factor in this type of filter separation.

Such a separator is now supplied in smaller sizes, suitable for chemical operations by the Selas Co. of Philadelphia and represents a little-used idea of the oil industry. No larger sizes are made as yet; the principle is waiting for adaptation in sizes suitable for and to purposes which are useful to the refiner in drying products or otherwise separating two or more immiscible liquids.



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QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Utilization of Propane—

We are looking for general information on operating internal combustion engines from propane gas fuel. Information such as safety precautions necessary; metering and regulating equipment required; and properties of the fuel itself would be very helpful to us. We would appreciate a bibliography of published material on this subject.—R.O.O.

It is beyond the scope of this page to present detailed mechanical information and hence it is suggested that advice be sought from supply companies (Phillips Petroleum Co., Bartlesville, Okla.; Skelly Oil Co., Tulsa, Okla., and many others) and from equipment companies such as Bastian Blessing Co., Chicago, Ill., which has accumulated comprehensive information on liquefied petroleum gases. Nevertheless, the bare essentials of a pressure-fuel-feed system is shown in Fig. 1. The use of propane, butane, or mixtures of them as an engine fuel has many advantages. Among these are: (1) The feed is a dry gas and air mixture so that crank-case dilution losses are entirely eliminated; (2) for the same reason, the fuel burns completely and cleanly, and (3) octane number is high (100-115), which gives smooth, powerful, and efficient operation without mechanical strains on the engine. Compression ratios of 7 to 10 are possible.

In a direct way these advantages result in less than half as many "overhauls" being required, an increased fuel economy up to even 30 per cent, and an increased power output up to 56 per cent.

As against these advantages, the use of a L.P.G. engine fuel requires the use of a pressure-fuel tank, somewhat complicated feed lines and safety controls, and additional dispensing equipment at service stations. There is the hazard of handling inflammable liquids (or gases) at pressures of 60 to 200 p.s.i. but to a large extent this is a matter of "fool-proof" equipment, safety devices, and careful inspection and operation.

General references on the handling of liquefied petroleum gases are as follows:

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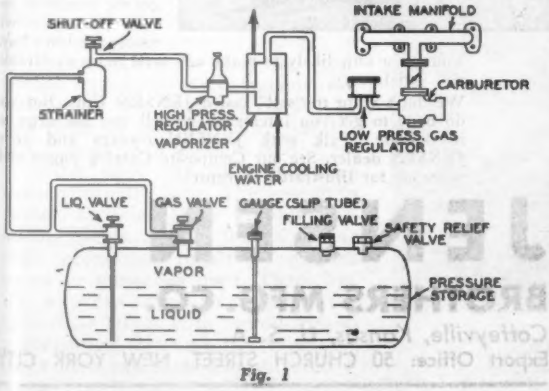

Fig. 1

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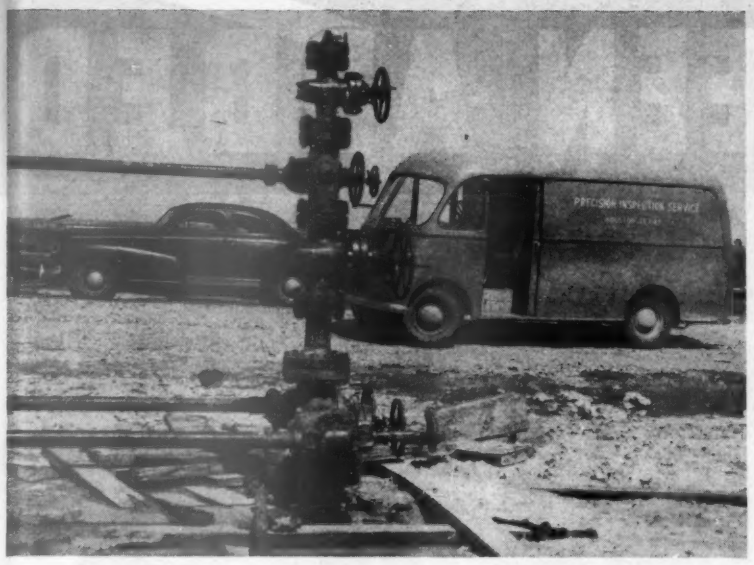
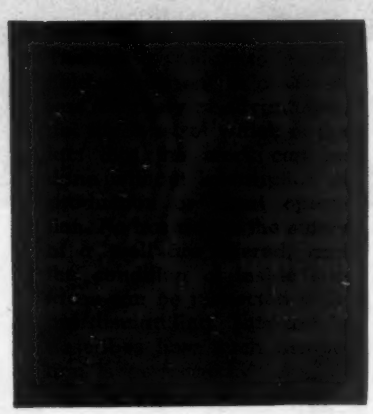


Fig. 1: Precision Inspection Service truck spotted on location where radium inspection was made on portion of christmas tree



by E. H. Short, Jr.

THE use of radium as a new tool for the field inspection of equipment in place is being given extensive consideration by many major oil companies along the Gulf Coast.

Until recent months, radium inspection work has been regarded primarily as a shop or laboratory procedure only. There is, as recent work has proved, no reason why such a limit should be placed upon a process having such great flexibility and value as a means of metal inspection.

As in the case of a great number of improvement strides made during the past few years, the war accelerated the demand for radium inspection of materials in the field to determine whether various types of equipment were free of defects, or to assure operators that the continued operation of equipment was safe under the imposed conditions. The demand for thorough checking and inspection of all field equipment is being more greatly emphasized than before the war. The reason is rather obvious, since greater producing depths, with the attending high pressures, result in greater stress in materials used. Then, too, the war has taken so much of the high-class labor, both technical and nontechnical, that quality of equipment in many cases has suffered.

Another important reason why the inspection of equipment has become particularly important at this time is that there is a large amount of equipment in operation which was manufactured during the time when an acute shortage of alloy materials prevailed. The necessity for turning out production quickly, very often with inadequate labor, has also contributed to the necessity for frequent inspection of oil-field equipment.

While the routine testing procedures generally employed in manufacturing plants are beneficial, it is possible for a piece of equipment to pass the usual tests satisfactorily and subsequently fail as the result of an inherent defect in the metal which was not revealed by initial testing and inspection, i.e., hydrostatic tests. In other words, a piece of equipment, which passes the hydrostatic test and is then placed on the christmas tree of a gas well, might not show a defect for 2 or 3 months. Water produces an oxidation effect which to a certain extent is responsible for self-sealing during a hydrostatic test.

The mention of the word radium in most instances is often mystify-

Fig. 2: B. J. Kalb, manager of Precision Inspection, in foreground supervising placement of film and radium

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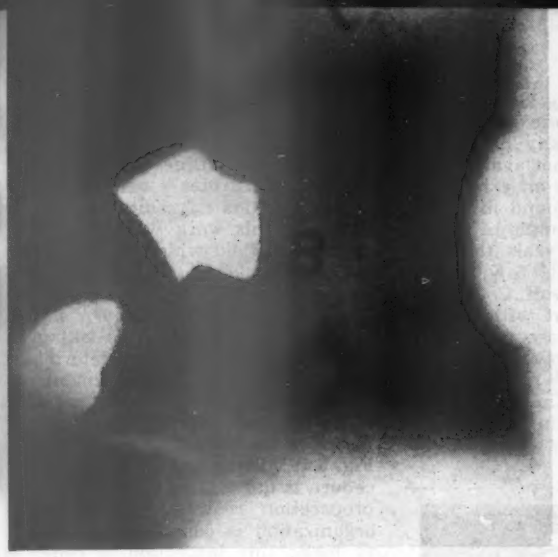

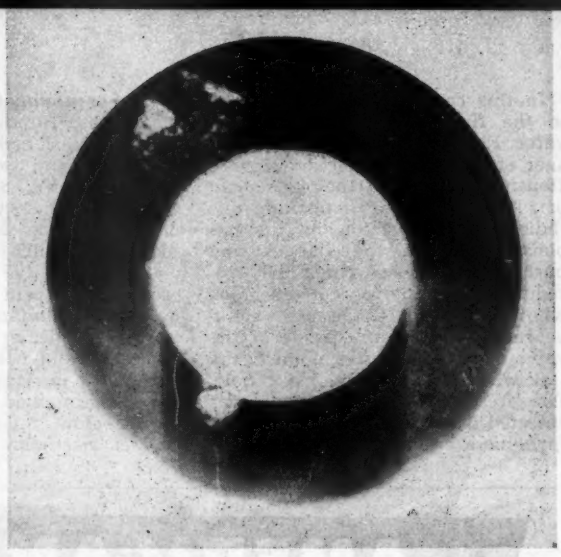

Fig. 3 (left): Two light spots in print (dark spots in film) show excessive sand found in side outlet of a tubing flange. Fig. 4 (right): Example of sand porosity brought out in field inspection shows as light spots in radiographic print

ing. By way of clarification as to the function, or what can be done with radium, a description of some of the unique and peculiar properties should be made at this point.

Commercial radium is offered to the market in a radium bromide salt form. It is sealed hermetically in containers in any desired quantities. The amount used is determined by the problem involved. Radium emits three types of rays which are designated as alpha, beta and gamma. The alpha and beta rays are of such a wave length that they do not penetrate metals for the purpose of commercial radiography. The gamma ray, however, is of such a short wave length that it possesses the ability to penetrate the molecular structure of any known substance. Its rate of penetration is determined by the type and thickness of the material under inspection and the amount of radium being employed. Radium will penetrate practically the thickness of any material if given sufficient time. The time element does, however, place some limitations upon the feasibility of its application; but for all practical purposes, steel thicknesses up to 6 in. can be inspected very satisfactorily by means of radium.

In the field inspection work discussed in this article, 300 mg. of radium are used. This is contained in a small cone-shaped plumb bob approximately 1 in. in length and ¾ in. in diameter at the base of the cone. The smallness of the source of energy permits the placing of the radium inside of any oil-field equipment in use. The radium is transported from one point to another in a special container called a radium vault. This vault is made up of a cylinder of lead having a wall thickness of 3½ in. The lead protection makes it safe for handling.

There is a great deal of misconception pertaining to the hazards of handling radium. While a certain amount of danger does exist, when it is used and handled by trained and competent experts, there is no risk whatsoever as far as other company personnel who may be present during radiographic inspection work are concerned.

Radium is used in the field to determine whether or not a defect is

Fig. 5: Examination of equipment in place. Film and radium holder shown. Radiographic inspection showed this particular piece of equipment to be free of defects

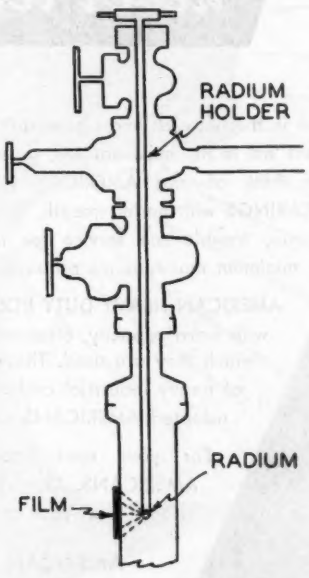

Fig. 6: Method of making radiographic inspection of tubing hangar in place

of such a size and proportion that an immediate replacement is necessary. It is also used to check the rate of internal-corrosion wear, and also to determine what percentage of metal wall has been destroyed or lost and whether or not the functional operation of such a piece of equipment has been impaired.

In this article two applications of radiographic inspection are described, and these reveal the ease with which radium may be employed in oil-field inspection work. Fig. 1 shows one of Precision Inspection Co.'s field service trucks spotted at a Gulf Coast well in preparation to the inspection of a portion of the christmas tree. The films are developed immediately after exposure inside the service unit.

In this case leakage was present in the flange of a christmas tree valve. Fig. 2 shows B. J. Kalb, manager of Precision Inspection service, Houston, revealing the placement of film and radium. In making this radiographic inspection the film was placed between the flanges and pushed into the seal ring. This procedure was employed to determine whether or not a leakage path could be revealed from the inside of the valve body to the outlet point of the leak which was inside the stud hole. The presence of sand porosity was detected in the film. The porosity or sponginess extended over a general area of approximately ½ in. in diameter. These films were turned over to the major company having the work done and are not available for illustration. Fig. 3 is an example of the type of defect found in flanges and Fig. 4 is an example of radium inspection which reveals the presence of porosity. Fig. 5 shows the setup in a recent Gulf Coast field to inspect equipment with radium. In this particular case the radium inspection did not reveal the presence of a defect. This photograph shows the method of placing the radium below the film. It was, of course, necessary to remove the radium from the holder before making the photograph, to prevent radium exposure of films in camera.

Fig. 6 is an outline of a christmas tree and illustrates a very interesting application of radiographic inspection. This work was done in a Gulf Coast field which was producing from a depth of 7,000 ft., with bottom-hole pressure at 1,900 p.s.i. The tubing hanger showed a slight leak, and the purpose of making a radium inspection was to determine whether or not the replacement of the tubing hanger was urgent, or whether repairs might be made by means of a clamp. In examining Fig. 6 it will be noted that the procedure is quite simple so far as the preparation required by the field organization is concerned. In order to make this inspection, a removable tubing plug was set in the tubing a short distance below the tubing hanger. The radium was then placed in a thin-walled steel tube and lowered to a point directly opposite the location of the leak.

The film was placed on the outside of the tubing hanger and covering the area of leakage. The direction of the radium beam was from the inside out, penetrating the slips and the wall of the hanger. The film revealed the presence of three defective areas. The leakage coursed along the lines of one of these defects. The other defects were of such a size and proportion that they represented an appreciable hazard. As a result of the information obtained in this instance, the placing of a clamp around the tubing head was not considered advisable as a permanent method of repair. However, it was decided to change the tubing hanger when a crew became available. The complete operation which included the setting of a plug in the tubing, placing of film, insertion of radium, and developing of film required a period of only 4 hours on location.

The applications mentioned in this article do not by any means illustrate all of the many practical applications of radiographic inspection of equipment in the field. A number of Gulf Coast operators have employed this method of inspection with many types of welded, fabricated or cast fittings used in connection work, and christmas trees. It is used to check the extent and rate of corrosion wear.

There are a number of advantages in the use of radium to inspect field equipment. There are no hazards to the safety of the well. In many cases the work can be done without interruption of production, or plant operation, and in cases where a shutdown is necessary, it is only for a short time. Radium inspection shows the condition of the inside surfaces previously impossible to check without dismantling.

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NEW EQUIPMENT

Emsco announces addition of triplex slush pump and portable mast to its line

EMSCO DERRICK & EQUIPMENT CO., 6811 South Alameda, Los Angeles 54, Calif., announces the addition of two new pieces of equipment to its line of oil-field drilling equipment. Designed after long and careful study by the Emsco research and engineering departments, the Emsco A-10 triplex slush pump and Emsco 12-P portable mast now offered to the trade are said to have many advantages over conventional equipment of this type. Both incorporate features to meet long-felt needs in oil-field drilling practices.

Triplex Slush Pump

The A-10 triplex is an all-steel pump having three double-acting cylinders in contrast to two double-acting cylinders found in slush pumps of conventional design. The fluid end and the power end are made of cast steel and structural shapes, which make the entire unit extremely light.

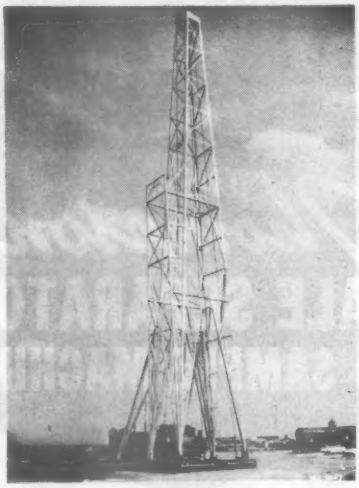
The triplex double-acting pump, having 6¼-in. liners and a 10-in. stroke, producing a mean effective pressure of 440 lb., will have six uniform surges of almost equal pressure and at even intervals. The high pressure in this case will be 465 lb. and the low will be 375 lb., or a difference of 90 lb. as compared with 280 lb. of a duplex pump. The horsepower requirement of the triplex pump at peak pressures will be 230 hp., six times per revolution of the crank and 187 hp. at low pressure during the same cycle. These even and uniform surges of low intensity will allow the prime mover to operate at a more constant power output.

The triplex pump with its constant even flow of fluid will save wear and tear on the pump, prime mover, V-belts, will not whip the rotary hose line and will not hammer the lines from pump to rotary hose.

The Emsco A-10 triplex slush pump incorporates all of the features which have made other Emsco slush pumps so popular. These include all-steel construction; less weight; exposed-type fluid liners; a fluid end easily repaired in the field by welding; renewable crosshead guides in frame; compact, rigidly welded power-end frame. It also utilizes the Emsco design of suction and discharge valves of the same size, in the same pot and under one valve cover.

The Emsco 12-P portable mast is fabricated in seven welded sections for convenient transportation. These sections are quickly and easily assembled on the ground or on cribbing. The crown and traveling blocks are strung for drilling and, with the aid of an auxiliary line, the mast is raised by the draw works. The skid base breaks down to road widths for hauling and is furnished in lengths to suit the rig. Any standard unitized draw works and any rotary table may be used.

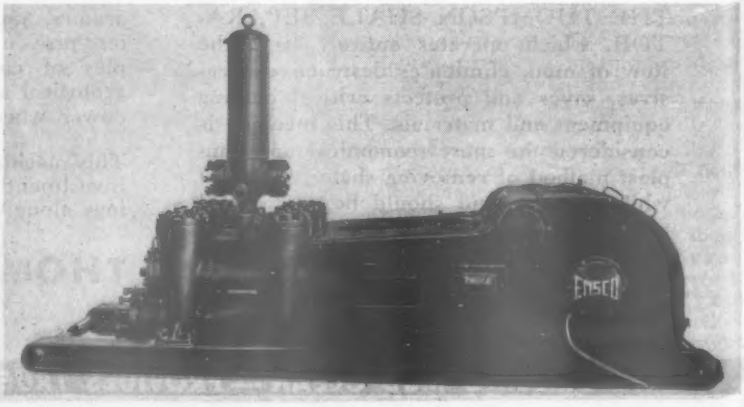
The mast is designed to permit perfect visibility, resulting in safety, because patented bulge construction for inside racking makes it possible to eliminate an open face and thus avoid interior bracing; the line arrangement used in raising and lowering the mast avoids the use of interior trusses; the legs are spaced symmetrically with respect to the center of the well, resulting in exceptionally favorable working conditions on the floor; a high V window affords the advantages of an open face without the disadvantages.



Raising and lowering of the mast under conventional operation constitutes a safety hazard. The method by which the 12-P mast is raised and lowered overcomes this. A positive strain is kept on the line at all times during the raising or lowering operation by means of a pivot point change. The center of rotation is shifted by an arrangement of the base connections, making it unnecessary to pull the mast off center when lowering it or to use a snub line when raising it. In other words, the center of gravity of the mast never passes over the pivot point and thus a slack line cannot develop. A dropped mast is not possible and safety is assured.

Lacing of all four faces results in a stiffer mast than can be secured by internal bracing. No guying is necessary. The crown block is concentrically mounted, resulting in an equal loading of the legs. This means better distribution of the load on the foundation. Working platforms are floored with heavy expanded metal, providing a nonslip surface without interfering with visibility. The platforms are hinged and can be folded up against the face of the mast if desired.

Standard equipment includes a catline sheave, built-in deadline anchor and ladders on both ginpole and mast. Optional equipment includes sandline sheave and crown safety platform. Unitized sectional steel substructures are available in 5-ft. 4-in. and 8-ft. 4-in. heights.



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1. Drill, with Spudder, from grass roots to 3,500 ft. 2. Drill, with Rotary, from grass roots to 5000 ft. (with independent driven pump). 3. Pull rods and tubing to 8,500 ft. 4. Drill-in wells to 7,500 ft. 5. Rotary clean-out and deepen to 7,500 ft. 6. Spudder clean-out and deepen to 7,000 ft.

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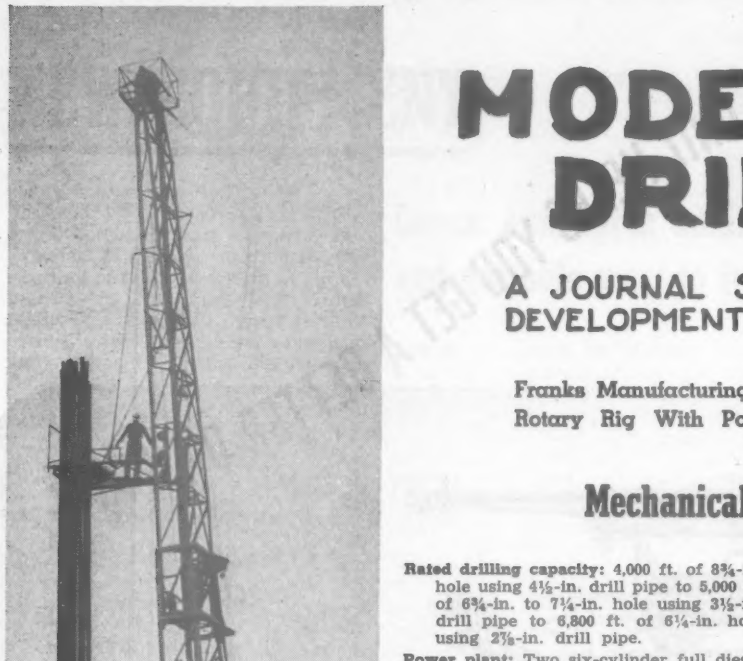
MODERN DRILLING

A JOURNAL SERIES ON NEWEST DEVELOPMENTS IN ROTARY RIGS

Franks Manufacturing Co., Tulsa, Truck-Mounted Rotary Rig With Portable Telescoping Derrick



Mechanical Specifications

Rated drilling capacity: 4,000 ft. of 8¾-in. hole using 4½-in. drill pipe to 5,000 ft. of 6¾-in. to 7¼-in. hole using 3½-in. drill pipe to 6,800 ft. of 6¼-in. hole using 2⅞-in. drill pipe.

Power plant: Two six-cylinder full diesel engines rated at 180 hp. maximum each (one, truck motor, the other bed-mounted).

Engine clutches: W. C. Lipe spring-loaded dry disk type, 15-in. single-plate heavy-duty.

Transmission: Industrial heavy-duty four-speed constant-mesh helical gear.

Power Takeoff: Franks' patented split-shaft V-belt-driven takeoff, with capacity to take full torque of truck engine.

Compound: Compound clutch, double plate dry friction type; compound drive multiple V-belt.

Drilling drum and shaft: Barrel—15¾-in. o.d. over grooved jacket; flanges—42⅞-in. diameter; width between flanges 32½ in.; shaft 4.3307 in.; radial bearing rated at 34,200 lb. capacity at bearing seats. Spooling capacity 11,000 ft. of ⅞-in. line, 6,225 ft. of ¾-in. line, and 4,580 ft. of ⅞-in. line.

Pump drives: V-belt.

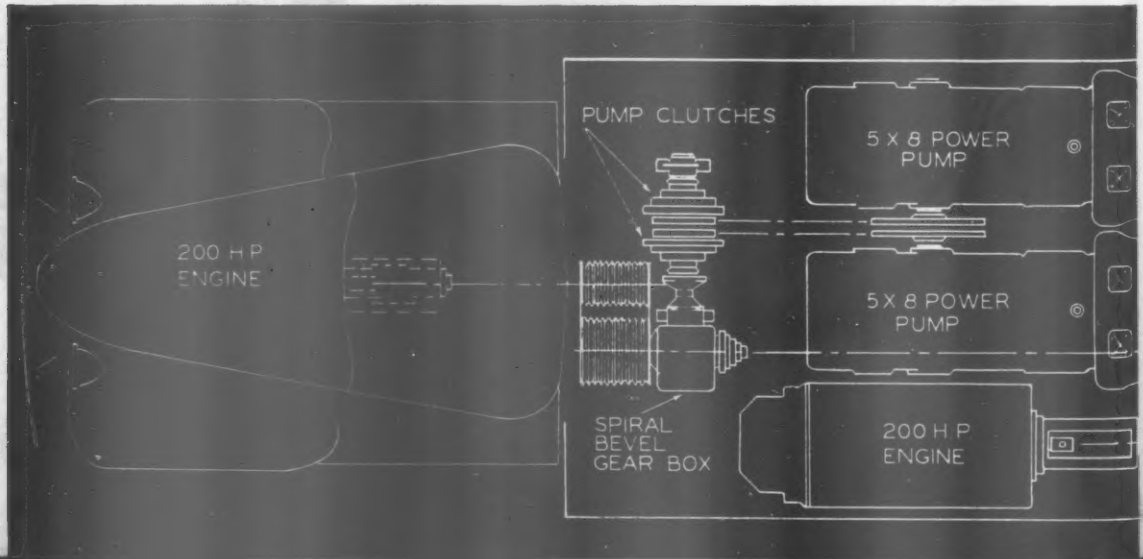
Bearings: Roller and ball, standard anti-friction.

Brakes: Full wrap beam equalized, free release, friction. Water cooling an available extra.

Derrick: 90 ft., 200,000 lb. telescoping type, road length 57 ft., road height 13 ft. 10 in., short position 57 ft., extended by 45,000 lb. capacity winch.

Derrick tilt: 2° to 4°.

***Left:** One of Franks Manufacturing Co.'s m-5,000-BT truck-mounted rotary rigs in operation, making a trip with 4½-in. drill pipe. Lines and blocks remain strung during moves; the telescoping derrick can be positioned for drilling in 20 minutes after reaching location. **Below:** Layout of dual power plant showing drives through to the two slush pumps, draw works, and rotary table. Clutches are air operated and have safety interlocks in system*



Salient Features

THE M-5,000-BT truck-mounted rotary drilling unit is a fully improved modern portable drilling rig with a 90-ft. telescoping derrick.

The unit is capable of stacking doubles; permits the lines and blocks to remain strung whether drilling or moving, and it requires but 20 minutes to raise and extend derrick to drilling position after reaching location.

The 100 per cent portable rig, comprising derrick, power plant, draw works, pumps and all essentials compactly unitized and mounted on a special Oshkosh Model U-906 truck, saves in rig-up and tear-down time and eliminates cost of erecting permanent derricks. Designed for deep slim-hole operation and medium standard drilling, saves fuel, water and labor; provides fast drilling with great savings in location-to-location moving and rigging.

Power Plant

The power plant consists of two Buda 6-DC-844 four-cycle full diesel engines of the solid injection type rated at a maximum of 180 hp. with 5¼-in. bore, 6½-in. stroke providing a displacement of 844.2 cu. in. The power plant is fully equipped with oil-bath air cleaner, lube-oil filter, electric starter and generator, ammeter, battery, governor, water-temperature indicator, bypass thermostat, fuel-oil filter and starter button.

The engine clutches are W. C. Lipe spring-loaded dry-disk type, 15-in. single-plate heavy-duty. The hydraulic coupling is of the latest design, 19½-in. American blower; the transmission utilizes an industrial heavy-duty four-speed constant-mesh helical-gear type, Fuller Model 4-A 1-86.

In an emergency the auxiliary engine can be used to propel the wheels on the road, since both engines can be compounded and full power of either or both engines can be delivered to any drive in the complete unit.

Draw Works

The draw works incorporates an angle-type spiral-gear box, single drum with cathead countershaft and a standard cathead is mounted on the driller's side, with American automatic cathead on the opposite side. The sprockets are generated tooth-cut steel. Spinning catheads (optional equipment) are single or double-drum types mounted in center of shaft, whereby the driller may handle spinning and tonging operations without leaving the controls. The installation of this cathead facilitates operations by a three-man crew and eliminates one of the hazards of common operation.

The drilling drum is built up of cast and rolled steel electrically welded into a single unit with grooved drum jacket.

Franks induced air-blast and water-vapor cooling for brakes is available as an optional feature.

Telescoping Open-Face Derrick

The 90-ft. 200,000-lb. derrick, telescoping, two-section, open-face, with integral crown block, is designed to be raised, extended and locked in one of two positions by power of hoist engine. The dimensions of the derrick are 57 ft. in length, 13 ft. 10 in. high, 8 ft. width.

The derrick is erected by a built-in mechanical raising and extending device, driven by the power of the hoist engine; no auxiliary engine, pumps, hydraulic lines or cylinders are necessary.

Projecting the upper section is accomplished by a small extending winch of 45,000-lb. ultimate capacity, also driven from the hoist engine.

Locking the derrick in either the high or low position is done by means of a pawl and lug mechanism (Franks patent), operated from the ground. Locking the derrick in either position is effected quickly and positively. The design of the pawl and lug is such that the load of the upper section, when extended, is placed directly on the legs of the lower section, therefore no bolting or clamping is required.

The derrick is generally used tilted from 2° to 4°.

Pumps and Drive

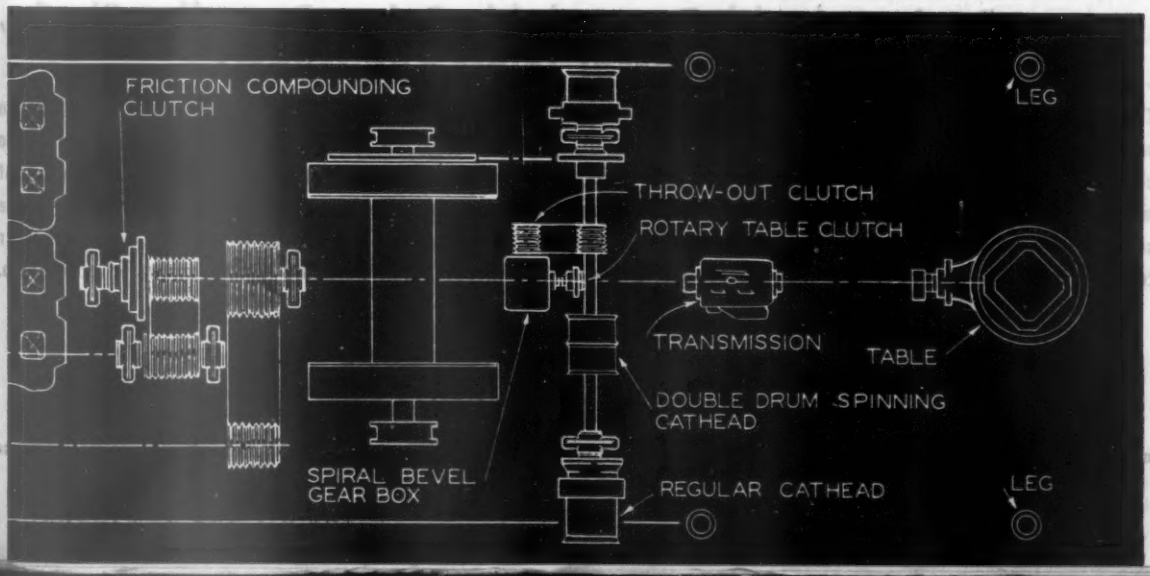
Two 5-in. by 8-in. duplex power slush pumps rated 185 g.p.m. at 540 lb. w.p.; fluid end 3,000-lb. hydrostatic test, with Franks universal pump drive.

Rotary and Coupled Shaft Drive

Fully enclosed, sealed, oil-bath roller-bearing table, static load capacity 212,000 lb.; Franks direct propeller shaft drive with universal joint coupling through four-speed transmission.

Air-Operated Finger-Tip Controls

Clutch control through graduated operating valves, air-operated controls with safety interlocks in system to avert change of engagement while parts are in motion, affords finger-tip control for all major operations except drilling drum brake and low-side clutch which are actuated through mechanical-manual linkage.



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Engineering Fundamentals

No. 161

A FEATURE OF THE OIL AND GAS JOURNAL

Effect of Natural Forces on Oil Production

ENGINEERS have divided oil reservoirs into four types on a basis of the origin of the predominating force which drives the oil from the sand into the wells. Recognition of the type of energy in a reservoir is very important, since the forces which propel oil through a sand determine more than any other factor, the manner of spacing of wells, the program for drilling and developing an oil pool, the correct method of finishing wells, and whether or not water disposal will become important.

Water-drive pools.—Water-drive pools are reservoirs in which the main propelling force is water. Such pools are generally situated within a continuous, porous, water-bearing sand sheet saturated with water except within the area occupied by oil. The water is under considerable hydrostatic head and in edge wells will rise nearly to the surface. Such reservoirs perform as follows: (1) The reservoir pressure remains high for a long time or throughout production unless the oil is removed faster than the water can advance to take its place. (2) The gas-oil ratio is generally low. (3) Edge wells soon begin producing water, and bottom water may appear in the early life of other wells. (4) The wells will continue to flow for a long time, generally until water comes in, unless the rates of withdrawal are excessive. (5) Total oil recoveries may be as high as 60 to 75 per cent of the total oil in the ground, if the pore spaces in the sand are well connected and the wells are properly located to recover the oil from the sweep of the water front. The East Texas field, the Yates field, and the Mexia-Powell fault line fields are examples of water-drive oil pools.

Expansion of gas-drive pools.—Gas-drive pools are those in which the main propelling force is the expanding force of gas dissolved in oil. Oil production of such reservoirs is characterized as follows: (1) The oil-production curve shows a rapid drop from an initial high and levels off soon at a very small fraction of the original rate (Fig. 1). (2) The wells soon must be pumped. (3) The wells do not produce water quickly even on the edges of the pool, and in some places very little water is produced in any well. (4) The ultimate oil recovery may be about 25 per cent and rarely is over 40 to 50 per cent. Pressure-maintenance programs, repressuring, and, finally, even water-injection methods are needed to increase the ultimate yield of oil. (5) Gas-oil ratios will gradually increase to a maximum and then decline rapidly; production virtually ceases when the gas is exhausted. Examples of these types of pools are the Fry pool in North Texas, the Lytton Springs and Hilbig serpentine-type pools in Central Texas, and the "shoe string" pools of Kansas and Oklahoma.

Gas-cap-drive pools. — Gas-cap pools are reservoirs which have a gas cap or gas area developed within the oil pool on the apex of the structure. With production, gas is released from the oil into the gas cap. As more and more oil is produced the gas cap expands in volume, replacing the oil downward. The performance of such pools is as follows: (1) Part of the gas released from the oil moves into the gas cap which consequently increases in size. (2) Gas-oil ratios are high in close proximity to the gas cap but low elsewhere. (3) Water-oil ratios are low, but water may appear in edge wells in low parts of the structure. (4) If gas is not removed from the gas-cap area, production decline may not be rapid, at least not as rapid as in gas-expansion pools. (5) The total recovery may be as high as 60 to 75 per cent provided the oil is taken out before the gas cap is depleted. Return of produced gas to the cap is beneficial; closing in all high-gas-oil-ratio wells is important. Examples of this type of pool are the old Cushing pool of Oklahoma, the Strawn townsite pool in North Central Texas and the Jones sand of the Shuler pool in Arkansas.

Combination of water drive and gas expansion. — Some pools may have only a moderate water influx combined with considerable gas expansion energy. These pools under sizable withdrawal rates, produce at first with the characteristics of gas-expansion control. Later, as the space voidage of the reservoir increases the bottom-hole pressure drops and this permits more and more water to enter from the edges of the structure. The production concurrently gradually assumes the character of a water-drive control.

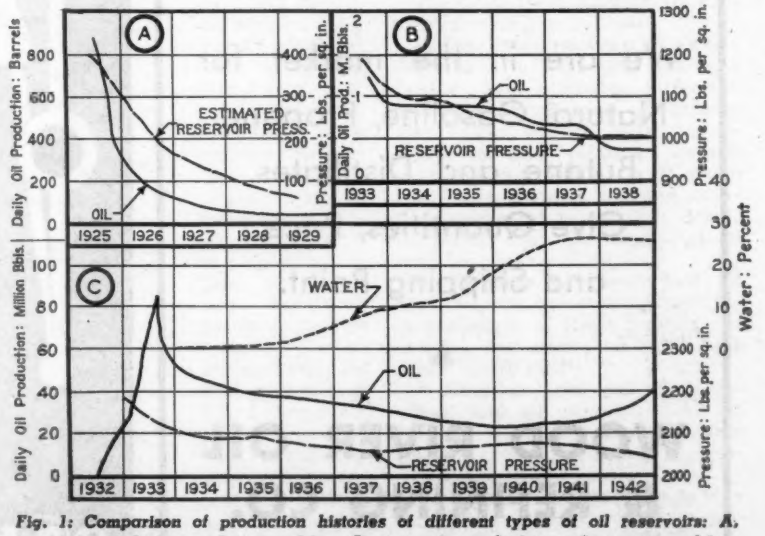

Fig. 1: Comparison of production histories of different types of oil reservoirs: A, reservoir producing under gas drive; B, reservoir producing under gas-cap drive; C, reservoir producing under water drive. Reservoir B would have a production history like A if the gas-cap area was drained and the gas energy not available

Series prepared by F. B. Plummer, professor, petroleum engineering school, University of Texas

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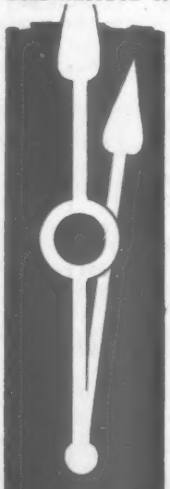

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The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Topping-Plant Flow

THE separation of dissolved gas, gasoline, naphthas, kerosene, stove distillates or diesel fuel oil, and sometimes gas oil from crude oil by the operation known as topping or skimming is a simple distillation conducted at atmospheric pressure. Tower pressures are only high enough (1-10 lb. per sq. in.) to force the products through the condensers or coolers and into the rundown tanks. The residue of this process is called topped crude oil, or may be called reduced crude oil if it is an extremely heavy or a highly topped product. Its value, if sold as fuel oil, is so low that the operation of topping (alone) is not economically feasible.

If large amounts of gas oil are desired, amounts requiring furnace outlet temperatures exceeding 650° F., the distillation is usually conducted in two stages, the second heating being referred to as reducing. This process usually involves the production of 65-85 per cent of distilled products of which 25 to 40 per cent is gas oil. Reducing is used mainly to produce the gas oil that is needed as a feed stock for other processes such as catalytic cracking, chemical synthesis, etc. Occasionally wax distillate (light waxy lube fraction) is produced.

Modern topping plants usually involve the use of only one main fractionating (or topping) tower. Older plants, particularly those that have grown in capacity, may employ many topping towers, and very old plants may still be employing shell stills.

Fig. 1 is a simplified diagram of a modern topping and reducing system. Figs. 2 and 3 illustrate what is usually found because of past expansion programs. Such systems require more pumps (mainly reflux), more control instruments, and many duplications of equipment but such systems can be operated just as effectively as that shown in Fig. 1. Not much choice between Figs. 2 and 3 is apparent except that the production of bottom (rather than top) products can usually be controlled most effectively, particularly if steam stripping is necessary.

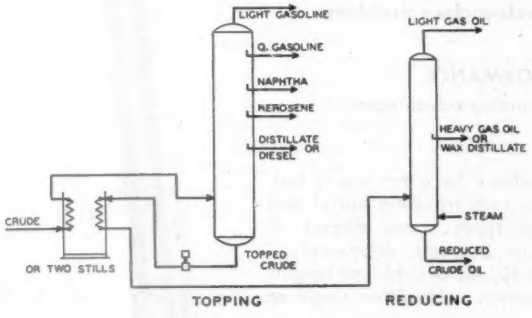


Fig. 1: Two-flash topping and reducing

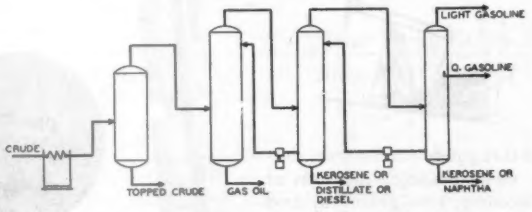


Fig. 2: Topping by successive fractionation

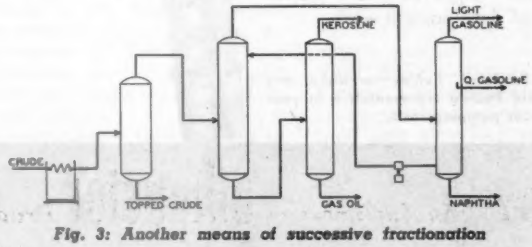


Fig. 3: Another means of successive fractionation

The products of topping are further processed as follows:

1. **Gasolines** and **naphthas.**—Sweetened to remove hydrogen sulfide and eliminate offensive mercaptan compounds. Extremely high sulfur content must be reduced by acid treatment, caustic neutralization and a rerun steam distillation. Caustic washing, solutizer treatment or catalytic desulfurization may be employed to gain lead susceptibility.

2. **Kerosene** or **diesel fuel oil** may require sweetening but the manufacture of these materials is usually not attempted with high sulfur crude oils.

3. **Distillate fuel, gas oil** or **residual fuel oil** usually require no further treatment. Residual fuel (topped crude) and gas oil are usually cracked into gasoline.

4. **Topped** or **reduced crude** may be further reduced in vacuum, primarily for raw lube distillate or for an asphalt residue, or it may be cracked. It is seldom sold as fuel.

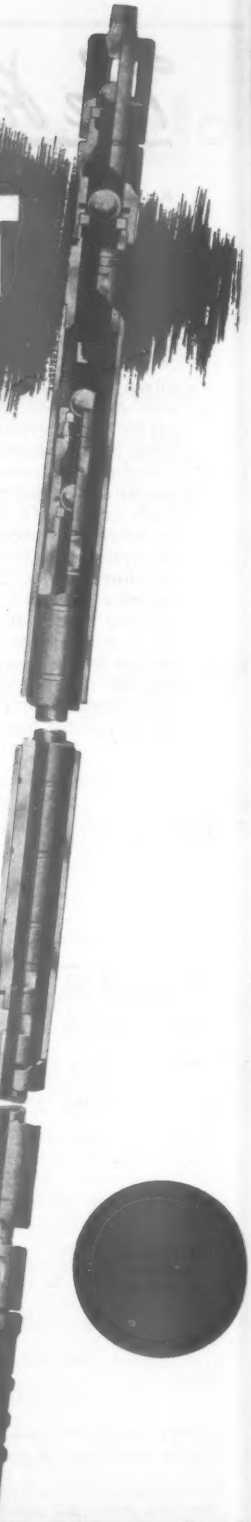
TENTATIVE SCHEDULE OF TOPICS

Installments of The Refiner's Notebook devoted to crude storage were Nos. 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 14, 16 and 18 (July 22 to November 18). Crude oil has been considered in Issues No. 9, 11, 13, 15, and 17, and about four others are being prepared. Topping processing is started in this issue and it will continue for many months.

No. 17 Sulfur in Oils
No. 18 Vent Lines — Vapor Handling
No. 19 Topping Plant Flow
No. 20 Comparison of Crude
No. 21 Symbols for Flow Diagrams
No. 22 Sour Crude Processing
No. 23 Combination Topping Plants

No. 19 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

FIRST COST



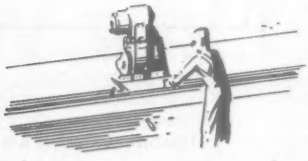
CONSIDER oilmaster "VOLUME PRODUCERS"

ALTHOUGH low price alone is no measure of economy, there are wells where *first cost* is important in the purchase of pumping equipment. So it's well to remember that precision-built, modern, dependable pumps ARE available . . . at an economical price . . . in OILMASTER "Volume Producers"!

Take this OILMASTER "Volume Producer" for example. Right off you can see that it looks like a quality pump. And it IS! It has the identical performance features that have made all OILMASTER pumps world famous for efficient production, reduced maintenance, lower cost. And . . . it's capable of meeting the most severe sub-surface problems.

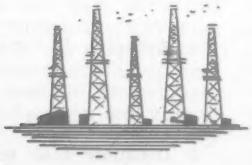
MAXIMUM LOW-COST PERFORMANCE

Here are a few of the "Volume Producer's" outstanding advantages:



In types—it's available for either top or bottom anchoring in both traveling barrel and stationary barrel types . . . has sleeves of either "Cor-Loy" or "Supreme" alloy steel . . . comes in 5, 7, 9, 10, 12, and 16-foot lengths and four diameters . . . with either single or double valves.

In operation—it's fast to install, easy to pull and pumps efficiently in both medium and large volume wells at all depths.



In construction—it is rugged, trouble-free, durable . . . and the same precision methods of heat-treating, honing, straightening and gauging are used that Fluid Packed perfected for the one-piece "Improved Insert" barrel after two years of development work.

For other features about lower-priced quality "Volume Producer" Pumps—or about any others in the OILMASTER Line—get in touch with the Fluid Packed representative in your district. He'll be glad to help you work out a way to cut your pumping costs.

Natural Gas

Gas-Measurement Course To Be Held in April

DALLAS.—April 17-19 is the tentative date set by the general committee of Southwestern Gas-Measurement Short Course for the 1945 course, Earl Kitlinger, Arkansas Louisiana Gas Co., Shreveport, chairman of the committee, announces.

At a meeting of the general committee here to make plans for the course, committee chairmen were chosen as follows:

C. A. Gibson, Cities Service Gas Co., Bartlesville, Okla., program; R. M. Scofield, Lone Star Gas Co., Dallas, exhibits; Miss Kate A. Niblack, Oklahoma Utilities Association, Oklahoma City, registration and publicity; Dean W. H. Carson, College of Engineering, University of Oklahoma, banquet, entertainment and local arrangements; W. H. Woods, Gulf Oil Corp., Houston, study of practical methods.

William D. Yale, The Texas Co., Houston, was appointed to the general committee to take the place of Max K. Watson, Canadian River Gas Co., Amarillo, who will become a member of the executive committee, of which Dean Carson is chairman.

Gas May Give Texas More Than Its Petroleum

AUSTIN. — Natural-gas resources of Texas will yield the state more money than will its remaining oil reserves, Col. Ernest O. Thopson, of the State Railroad Commission, declared last week.

"You cannot build up a more prosperous union by erecting trade barriers against a free flow of commerce between the states," he said. "Some might say, 'But we will soon be out of gas.' The same reply could be given as to oil. But I have not heard of anyone suggesting that we ship no oil out of Texas. We hunt for markets for all our products and heretofore we have been glad to have a market.

"One constructive thing would be a rule or law that no oil could be produced unless the gas that came out with the oil was returned to the reservoir for maintaining the reservoir pressure or stored or fully utilized for light or fuel or for manufacturing synthetic products. That would be real conservation and waste prevention."

Manufacturers to Acquire Five Affiliate Companies

WASHINGTON. — Federal Power Commission will hold a hearing November 27 on an application filed by The Manufacturers Light & Heat Co., a new corporation, for permission to acquire and operate all the facilities of The Manufacturers Light & Heat Co., the constituent company, Greensboro Gas Co., Manufacturers Gas Co., Pennsylvania Fuel Supply Co. and Fayette County Gas Co. All are subsidiaries of Columbia Gas & Electric Corp., with offices in Pittsburgh. The newly organized Manufacturers Light & Heat Co., after it acquires the properties of the other companies, will take over their operations.

All the companies are engaged in the production, purchase, transmission and distribution of natural gas in western Pennsylvania. In addition, The Manufacturers Light & Heat Co. (an old corporation) does a similar business in eastern Ohio, northern West Virginia and southern Pennsylvania. It also purchases artificial gas in western Pennsylvania and transports and distributes mixed gas in western Pennsylvania, eastern Ohio and northern West Virginia.

New York State Natural to Buy Facilities It Leases

WASHINGTON. — Federal Power Commission last week authorized New York State Natural Gas Corp., with principal offices in Pittsburgh, to purchase certain facilities it now operates under lease from Peoples Natural Gas Co. The facilities include about 89 miles of 12-in. pipe line extending from a point in Clarion County to a junction with New York State Natural's line in Potter County, Pennsylvania; a private telephone line paralleling the pipe line, and 58 ft. of 12-in. pipe line extending between the line to be acquired and Peoples Pew compressing station. These have been operated since December 5, 1939, under lease from Peoples at an annual rental of $120,000, and New York State Natural has been purchasing gas from Peoples since the same date.

The commission last April authorized New York State Natural to construct and operate 127 miles of 12¾-in. pipe line extending from the Pennsylvania-West Virginia boundary line to a point of connection with the leased line of Peoples near the Pew compressing station. Last week's order states that construction of this line will permit New York State Natural to receive gas from Hope Natural Gas Co. in substitution for that purchased from Peoples. Ownership and operation of the line to be acquired from Peoples will provide New York State Natural with a continuous pipe line from this new source of gas supply.

New York State Natural is to pay for the facilities acquired $815,256.77, which is represented as being the depreciated original cost as of December 31, 1943. The company plans to operate the facilities as an integral part of its existing system in New York and Pennsylvania.

Supreme Court to Review Panhandle Rate Case

WASHINGTON. — The Supreme Court last week agreed to review an order of Federal Power Commission directing Panhandle Eastern Pipe Line Co. to lower its wholesale rates for natural gas. The commission acted on a complaint by the city of Detroit and Wayne County, Michigan.

The company's system extends from the Panhandle field in Texas and the Hugoton field in Kansas, Oklahoma and Texas, through Oklahoma, Kansas, Missouri, Illinois, Indiana, Ohio and Michigan, with termini in Indiana, Ohio and Michigan.

The commission's order allowed a 6½ per cent return on a rate base of $67,137,305. The company protested, among other things, that this base did not include the cost of properties under construction and said the resulting return was inadequate. The Eighth Federal Circuit Court upheld the commission order.

November Gas Quotas Are Set for Kansas Pools

WICHITA.—Conservation Director T. A. Morgan, of Kansas Corporation Commission, announced last week that allowed production for November in the Otis pool in Rush and Barton counties had been set at 1,288,000,000 cu. ft. The commission at the same time set production in the Cunningham field in Kingman and Pratt counties at 420,000,000 cu. ft.

NATIONAL IDEAL

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THE 88" Type T Traveling Blocks are designed for the heaviest rotary drilling service. They have five 48" diameter independently mounted sheaves all in line, each sheave on separate roller bearings and held in a fixed lateral position on the large 10¼" diameter center pin.

The feature of these blocks is that they are available with three selections of bearings, the adaptation of each depending on the degree of service expected.

1. STRAIGHT ROLLER BEARINGS WITHOUT OUTER RACES. Type 548-T. The standard block, with straight roller bearings running in the precision-ground bore of the steel sheaves. Bronze thrust washers are locked in position between each sheave, thus eliminating lateral thrust and minimizing wear of the sheave hubs.

2. STRAIGHT ROLLER BEARINGS WITH OUTER RACES. Types 548-TC and 548-TCH. These blocks have the straight roller bearings running in hardened outer races pressed in the sheaves, thus providing a bearing with longer life expectancy. The outer races are replaceable and axial thrust is taken by bronze thrust washers between the sheaves. The "TC" and "TCH" blocks are identical except that the "TCH" is designed to accommodate links for connection to the Ideal Hydraulic Weight Indicator.

3. DOUBLE-ROW TAPERED ROLLER BEARINGS. Types 548-TC and 548-TCH. These blocks may be furnished with one or more sheaves mounted on tapered roller bearings, which offer the ultimate in bearing life expectancy for high speed operations and are especially recommended for the fast sheaves. The tapered roller bearings are enclosed and the use of thrust washers between the sheaves is eliminated, since the bearings take all axial thrust.

Type D-12 4-Sheave

Ideal Type D Traveling Blocks carry each sheave on a double row tapered roller bearing, thereby eliminating the necessity for spacers. All sheaves are heat treated steel and rotate on readily replaceable hardened and ground inner and outer races of the double row tapered roller bearings. The complete bearing in each sheave is individually lubricated and sealed against water and dust by labyrinth type oil seals. Alemite fittings, recessed at each end of the center pin, insure positive lubrication of the sheave bearings by separate grease passages through the center pin.

Block Size	D-6	D-12	D-20	D-20
Ratings	60 Tons	120 Tons	200 Tons	200 Tons
Number of Sheaves	3	4	4	5
Wire Rope Dia., Std., inches	1	1⅛	1⅛	1¼
Sheave Diameter, inches	30	34	38	38
Center Pin Diameter, inches	5⅛	7½	9⅛	9⅛
Lower Clevis Section, Width x Depth, inches	3x6	4½x8	5½x10	5½x10½
Lower Clevis Pin Dia., inches	1¾	2½	3¼	3¼
Length (Overall)	4'-7¾"	5'-6¼"	6'-3⅛"	6'-3⅛"
Width (Overall), inches	32¾	36¾	40⅛	41
Face (Thickness), inches	16⅜	24⅜	30⅛	35⅛
Net Weight, pounds	2450	4030	8000	8500
Weight, Packed for Export, lbs.	2650	4180	....	....

REFINING

Gulf's New Lube Plant Ready for Operation

HOUSTON.—Gulf Oil Corp. last week announced completion of an expansion program at its Port Arthur, Tex., refinery which will increase the output of lubricating oil by more than 1,000 bbl. daily. The product is especially suitable for aircraft use.

The new facilities consist of a deasphalting plant, a phenol solvent extraction plant, and a M.E.K. dewaxing plant. The entire output will be delivered to the Army Air Forces and the Navy Bureau of Aeronautics.

Already operating at 100 per cent capacity, the first shipment of oil made with the new equipment was shipped to the Army Air Forces. By virtue of the design of facilities, the new addition can be used after the war for the manufacture of aviation, automotive and industrial oils. The project was completed under War Production Board priorities and was financed with private funds.

Aviation Gasoline Without Oil Seen as Possibility

CHICAGO.—Possibility of making aviation gasoline without petroleum as its source is being studied in the interest of national defense, Dr. V. I. Komarewsky, professor of chemistry at Illinois Institute of Technology, revealed here last week at a meeting of Western Society of Engineers. His paper, which contained the announcement, was prepared in collaboration with Prof. C. H. Riesz, associate chemist at the institute.

Because of possible reduced supplies of petroleum, Dr. Komarewsky said, alternative fuels should be developed. The institute has begun research into the potentialities of the Fischer-Tropsch process of making motor fuel from coal or natural gas.

A recent development of the process, known as "iso-synthesis," is of importance because it may mean that higher-octane aviation gasoline can be produced. Additional research is needed, however, before the Fischer-Tropsch synthesis can be used to produce this gasoline.

The Fischer-Tropsch process has been effectively utilized by Germany and Japan in their war programs. Since the middle of 1943, scientists at the U.S. Bureau of Mines have been investigating its possibilities.

The new development will have importance to gas companies, for either natural or manufactured gas may be used.

Big Output Record Made by Synthetic-Rubber Plants

HOUSTON. — Two synthetic-rubber plants at Port Neches, Tex., are producing as much rubber as could be obtained from 28,000,000 rubber trees, according to officials of the Firestone and Goodrich companies, which operate the plants.

Twin plants of the two companies have produced 195,000,000 lb. of rubber in approximately 1 year. This

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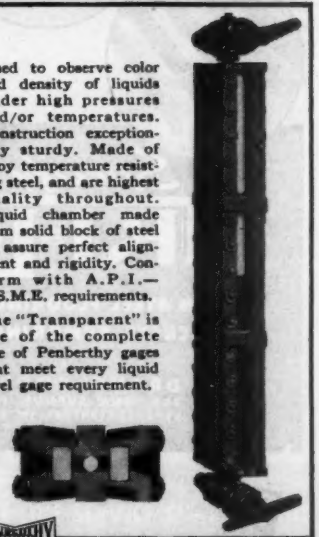

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

is estimated to be the normal yield of 28,000,000 rubber trees.

The plants get their butadiene, major rubber ingredient, from Neches Butane Products Co. at Port Neches, which is supplied with raw material by five large oil refineries in the area.

Oil Workers Union Chosen Bareco Bargaining Agent

BARNSDALL, Okla. — Oil Workers International Union (CIO) was chosen to be the bargaining agent for refinery employes of Bareco Oil Co. here last week, in an election conducted by National Labor Relations Board. The CIO organization received 137 votes, and the Bareco Refinery Employes' Association received 54. Seven persons voted against both unions.

New Light-Weight Drum to Step Up Fuel Shipments

PITTSBURGH.—Manufacture of a light-weight drum that will step up flow of aviation gasoline to the China war theater is announced by Aluminum Co. of America. The drum weighs only 21 lb. The standard drum weighs 52 lb.

Company officials said the Air Transport Command had accepted the new drums and had already flown an allotment of gasoline to India. These drums will increase the supply of aviation gasoline at vital points by many hundreds of thousands of gallons each month, according to the company.

Valley Refining Is Assured Increased Crude Supply

ARTESIA, N. M. — Additional crude supply for Valley Refining Co., which operates a combined cracking and skimming plant, is assured with the laying of a projected 4-in. pipe line from the Caprock pool in northwestern Lea County to the company's Dexter pipe line station. The plant has a capacity of 1,500 bbl. daily. Both Petroleum Administration for War and War Production Board have approved the company's project. The Caprock pool has six producers with a daily output of 219 bbl. Development of the pool has been handicapped by lack of an outlet.

Movement of Oil Products By Tanker Increasing

WASHINGTON.—Tankers are carrying a gradually increasing proportion of oil products to the East Coast region, records of Interstate Commerce Commission reveal. During the first 9 months of 1944 some 65,000,000 bbl. moved by the water route. This is 14 per cent of the total transported to the coast, compared with 10 per cent in 1943.

Movement by all methods of transportation to the Atlantic seaboard amounted to approximately 465,000,000 bbl. during the first 9 months and if the same rate is maintained during the rest of the year the 1944 movement will be in the neighborhood of 620,000,000 bbl. against 508,000,000 in 1943.

Sinclair Hangs Up Record In Butadiene Production

HOUSTON.—Sinclair Rubber, Inc., subsidiary of Sinclair Refining Co., has established a record output of 175 tons of butadiene daily since November 1. This is about 25 per cent above the rated capacity of the plant, which is 50,000 short tons of butadiene per year. This translates into about 60,000 long tons of synthetic rubber after combination with styrene.

E. W. Isom, president of Sinclair Rubber, Inc., said: "This plant will make production of synthetic possible at a lower cost on a postwar basis than any probable natural rubber cost."

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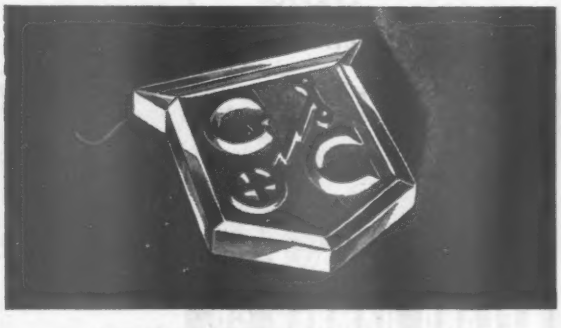

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PIPE LINES

India-China Line Serves Army Operations

Secrecy of the last 2 years has been lifted with disclosure by the American Army, at New Delhi, India, that the main portion of a fuel pipe line which ultimately will reach from Calcutta to China across Burma has been completed.

Already the longest military operational pipe line in the world, its construction has been one of the war's most remarkable engineering feats.

When completed it will at least have a capacity which will be double that of the Ledo road. The pipe line crosses three rivers and will cross several more. Allied forces in North Burma already are being supplied gasoline from the line.

Along railroads, highways and streams, it follows the main arteries of travel northward from Calcutta into northeast India where it swings over into Burma toward China. The exact course the pipe line takes after leaving the beginning of the Ledo road in Assam cannot be disclosed.

It is reported from Chungking that the line extends from Calcutta through the Brahmaputra Valley to Assam and then across the Patkai range and that it is constructed of 4-in. and 6-in. pipe.

One part of the system is used to fill the tanks of Superfortresses in India; one of its major tasks is to feed gasoline into the planes ferrying fuel to Maj. Gen. Claire L. Chennault's 14th Air Force in China.

The effect of the pipe line in China will be to free much of the air transport and Ledo road tonnage for carrying guns and other war essentials to the Chinese and to the 14th Air Force. It will mean Chennault will have gasoline for a vastly increased air force.

Refined products will be batched through the line.

Brig. Gen. Thomas Farrell, formerly of New York, is chief engineer on the job. The pipe, brought from the United States, is laid by Chinese, Indian and American crews. Frequently the crews were on the heels of combat units which had to clear the Japanese out of some areas the same way a route was cleared for the Ledo road. The road is almost complete now.

Mexico Plans to Build Pipe Lines and Tankers

Petroleos Mexicanos, the Mexican Government oil organization, is reported to be planning a program for expanding transportation facilities by building four pipe lines and a fleet of tankers. These will improve efficiency and provide better means for serving markets. Total cost of the pipe lines to be built is $5,773,000.

Largest of the four projected pipe lines will extend from oil fields near Tampico, on the Gulf Coast, to the Pacific seaport of Mazatlan, which the Mexican Government is attempting to develop as the chief West Coast petroleum center. This line will cost about $3,093,000 and will take 2 years to build.

Another pipe line will run from the Ebano oil fields on the East Coast to San Luis Potosi, important mining center, and the third will

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  - —at yard or railhead
  - —over the ditch
- Pipe Cleaning Service
- Pipe Storage
- Pipe Delivery

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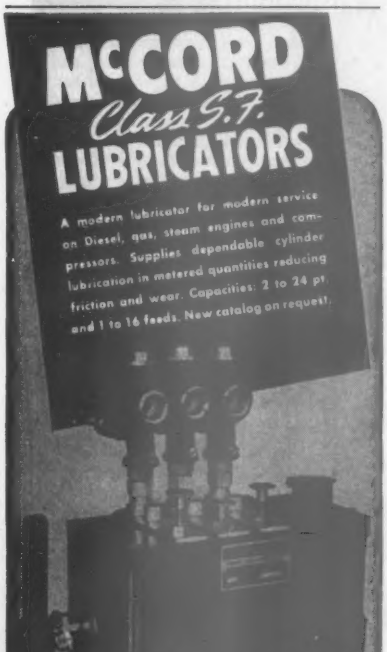

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DETROIT, MICHIGAN
LUBRICATOR DIVISION

connect the San Benito fields south of Vera Cruz with Tapachula on the Guatemalan border. Cost of these two pipe lines will be approximately $2,062,000.

The fourth line will run from Tamasopo, near Tampico, to Cardenas, an important railroad junction in the state of San Luis Potosi. This line is being built by Mexico's national railways in cooperation with Petroleos Mexicanos, known as Pemex at an estimated cost of $618,000.

When it is completed, this line will release much of Mexico's rolling stock now employed in carrying petroleum products.

The plan is to carry oil by tank cars from the oil fields to Tamasopo and then pump it over the pipe lines to Cardenas.

Pemex has contracted for the construction of 22 tankers, of steel and concrete design, for coastwise traffic and for shipment of oil products to Central and South America. First of these tankers is expected to be ready by the end of the year.

At the present time, American specialists are in Mexico City aiding in planning a new refinery at Atzcapotzalco, in the capital area, on which work is expected to begin early next year.

W.E.P. Lines Earn $100,000 Per Day

Secretary of Commerce Jones has released figures showing that the Government's 24-in. crude-oil and 20-in. products line, operated by War Emergency Pipelines, Inc., are returning a net profit of about $100,000 a day.

But the entire Government program of oil transportation is in the red between $200,000,000 and $250,000,000, officials of Defense Supplies Corp. said, because of the payment of subsidies to eastern oil companies which ship by tank cars instead of by tankers.

D.S.C. supervises the pipe lines, the big-inch and the little big-inch, as part of its program to equalize the cost of all petroleum products moved to the East.

Home to Lay 90-Mile Line To Its Great Falls Plant

Home Oil & Refining Co., Great Falls, Mont., plans to build a 90-mile 5-in. crude-oil pipe line with 5,000-bbl. daily capacity to cost approximately $500,000 to connect the Cut Bank and Pondera fields with the company's refinery at Great Falls.

The line will connect at Cut Bank with a line of Producers Pipe Line Co., serving the Cut Bank field, and near Conrad, in the Pondera field, will connect with lines of the Pondera Pipe Line Co. Both concerns are subsidiaries of A. B. Cobb Co.

Iraq Petroleum Co. executives on a visit to pipe-line operations in the United States: H. A. Hammick, chief engineer, London, England; F. C. Ryland, general superintendent, Haifia, Palestine

A. B. Cobb, who is president of Home Oil & Refining Co. as well as A. B. Cobb Co., has 56 producing wells in the Cut Bank field and 78 in the Pondera field.

Material for construction of the line is being assembled at key points. Steel for the project was released by the War Production Board because of the need for codimer (used in making 100-octane gasoline), produced at the Great Falls refinery by Home Oil & Refining Co.

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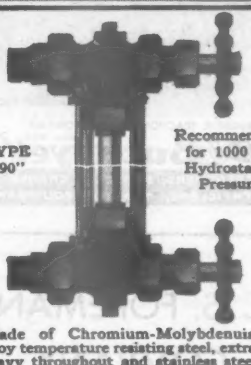

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Exploration and Drilling

Week's Highlights

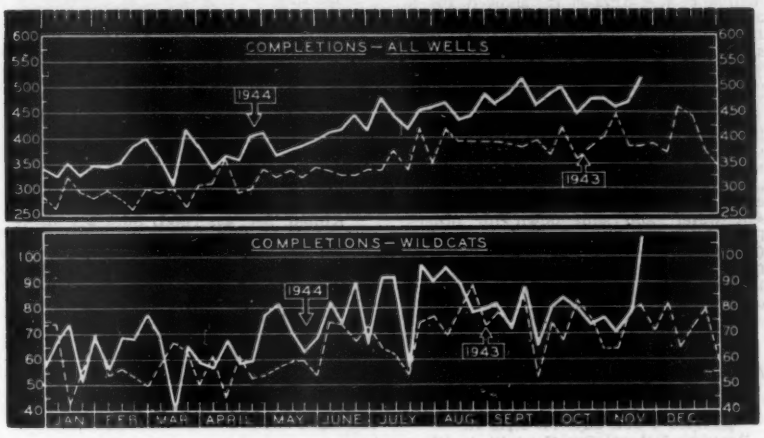
THE Wilcox play in the Anadarko basin is reaching a stage where both operators and geologists are beginning to wonder. The big question is whether the Wilcox pools are going to be a series of small pimples or whether somewhere, one or more of the recent discoveries is going to develop into at least a moderately sizable pool.

The West Moore pool of Cleveland County cannot be written off the books as yet, because the recently completed J. E. Crosbie-Warren Petroleum Co. 1 Stotts, while not the 5,000 to 10,000-bbl. well that seemed possible from drill-stem tests, is good enough to offer possibilities that there may be a fair-sized oil pool to the north and west. On the other hand, some geologists think West Moore is only a slight terracing in a normal monoclinal dip, and will therefore probably be a knife-edge pool of small size.

The South Moore pool now has a good offset to the south of the discovery well, but two wells farther south, one southeast and the other southwest, are disappointments. It still has to prove itself to be of substantial character, and the geological opinion of South Moore divides into the same two schools as on West Moore, with the substantial structure present believers carrying the burden of proof.

Farther south, in McClain County, The Carter Oil Co. has had two hits out of three tries; its Cottingham well opening Washington pool, and its Johnson opening the West Noble prospect. These were drilled on local highs on what is believed to be a broad regional high. No offsets are deep enough to tell much on this, as yet. While both discoveries had some troubles in shutting off water, and this is not encouraging, it does not preclude the possibilities of a substantial field around either or both discoveries.

Two and a half miles north of the Washington pool, Carter's 1 Lamar ranch is drilling at 10,365 ft. in the Sylvan. On top of the Hunton, this test checks 182 ft. lower than the Washington pool discovery, and on top of the Sylvan it checks 131 ft. lower. This indicates some thinning of the section, but not as much as one would like for encouragement.



Solid line charts current weekly completions, service wells in Eastern area not included

COMPLETIONS IN ALL FIELDS . . .

Week ended November 18, 1944

	Oil	Gas	Dry	Total	Footage	Total Comp. to date 1944	1943
N. Y., Penna., W. Va.	62	15	*59	*136	189,824	†5,522	3,056
Ohio	2	10	8	20	55,741	893	835
Indiana	1	0	5	6	10,905	229	197
Kentucky	8	0	8	16	31,098	662	406
Illinois	29	0	19	48	117,306	1,701	1,564
Michigan	5	2	10	17	43,206	604	562
Kansas	19	2	29	50	164,672	1,636	1,503
Nebraska, Missouri, Iowa	0	0	0	0	0	35	44
Oklahoma	33	1	24	58	213,033	1,620	1,050
Texas:							
North Central	19	0	22	41	97,416	1,300	1,325
West	28	1	6	35	189,795	1,407	814
Panhandle	6	1	1	8	23,548	254	160
Eastern	0	2	2	4	19,682	286	270
Gulf Coast	15	5	9	29	217,170	1,119	417
Southwest	8	0	6	14	44,524	602	815
Total Texas	76	9	46	131	592,135	4,968	3,801
Louisiana:							
Northern	2	1	2	5	28,764	286	293
Southern	8	1	2	11	105,796	427	327
Total Louisiana	10	2	4	16	134,560	713	620
Arkansas	6	0	1	7	48,143	195	240
Mississippi	6	0	4	10	58,761	134	89
Southeastern States	0	0	0	0	0	44	‡
Montana	6	0	0	6	20,502	316	210
Wyoming	1	0	2	3	14,854	153	120
Colorado-Utah	1	0	0	1	5,577	31	22
New Mexico	4	0	4	8	20,182	355	202
California	33	0	9	42	165,818	1,771	1,210
Total United States	302	41	232	575	1,886,317	†21,582	15,731
Total previous week	276	53	193	522			
Total Nov. 20, 1943	222	35	131	388			

*Includes 55 pressure wells. †Includes service wells in Appalachian area. ‡Included in total shown for Mississippi.

N. CENTRAL TEXAS

May Get New Caddo Lime Pool in Wichita County

WICHITA FALLS.—James Stewart & Co. 3 E. B. Madden, Wichita County test in Block 8, Wm. Mayer Survey A-193, 5 miles west of Wichita Falls, topped Caddo lime at 5,070 ft., made a 30-minute drill-stem test 5,072-90 ft., showed gas in 3 minutes and recovered 2,900 ft. of oil. It drilled ahead, logged conglomerate with slight oil show at 5,118-28 ft., total depth, where it recovered 15 ft. of oil-cut mud on drill-stem test, then ran and cemented 5½-in. pipe at 5,126 ft.

In Hardeman County, Amerada Petroleum Corp. 1 Conley, 8 miles southeast of Quanah, plugged back to 5,350 ft. from total depth 5,800 ft., then made a 90-minute drill-stem test 5,341-50 ft., recovered mud with slight oil show and 1,365 ft. salt water, and shut down for orders. Pure Oil Co. 1 Flowers (Little), Grayson County deep test, was drilling below 8,180 ft. in sandy shale. R. B. Campbell et al 1 Kaker, Wise County wildcat southeast of Bridgeport, was drilling below 780 ft.

NORTH TEXAS WILDCAT COMPLETIONS

Archer County: A. P. Kouri et al 1 W. A. Keyes, J. M. Swisher Sur., A-396, 5 mi. NE Megargel, elev. 1,131 ft., pumped 4 bbl. day, TD 1,119 ft.

Republic Natural Gas Co. 1 W. L. King, Wm. Henry Sur., A-163, 1 mi. E Archer City, elev. 1,074 ft., Caddo 4,990-5,010 ft., dry, TD 5,684 ft.

Avis B. Taylor 1 J. D. Carpenter, Blk. 4, Lot 88, Clark & Plumb Sur., 6½ mi. E and 2 mi. S Archer City, dry, TD 1,113 ft.

White & Duncan 3-A J. T. Richardson est., Lot 9, Jonathan Scott Sur., A-374, 9 mi. S and 10 mi. W Archer City, dry, TD 1,302 ft.

Cooke County: Phillips Petroleum 1 Bailey Inglish, J. F. Davidson Sur., A-336, 2½ mi. W and 1 mi. S Hood, elev. 905 ft., dry, TD 2,510 ft.

Grayson County: Seitz, Comegys & Seitz et al 1 J. B. Walling, Sara Gross Sur., 3 mi. E and ½ mi. N Tioga, elev. 679 ft., Ellenburger 4,200 ft., dry, TD 4,387 ft.

Montague County: S. D. Johnson et al 1 M. E. Vaughn, J. M. C. Jesse Sur., A-400, 1 mi. N and ½ mi. E Nocona, elev. 936 ft., Ellenburger 5,353 ft., dry, TD 5,405 ft.

Throckmorton County: Bridwell Oil 2 Mable Richards et al, Andrew J. Morgan Sur., A-226, 8 mi. S and 2 mi. W Throckmorton, elev. 1,323 ft., dry, TD 557 ft.

John T. Cross 4 Sallie Harrell, S. Stroud Sur., A-1282, 12 mi. S and 2 mi. W Throckmorton, elev. 1,325 ft., dry, TD 600 ft.

Wichita County: Jackson & Davenport 1 S. M. Wilson, Sec. 3, SPRR Sur., A-265, 3 mi. N and W Holliday, elev. 1,023 ft., dry, TD 1,840 ft.

Texas Co. 14 Fred Thom, W. H. Spillers Sur., A-257, 3 mi. W and 1 mi. S Kamay, dry, TD 1,834 ft.

Young County: Wilmac Oil 1-B Marietta Killian, Sec. 22. TE&L Sur., 2½ mi. S Olney, dry, TD 1,020 ft.

WEST CENTRAL TEXAS WILDCAT COMPLETIONS

Coleman County: Hunter & Hunter 1 Mrs. M. C. Woodward, R. Howell Sur. No. 154, 1 mi. W Coleman, elev. 1,838 ft., Gardner 2,649 ft., dry, TD 2,865 ft.

EASTERN TEXAS

Henderson Co. Wildcat Has Good Show

DALLAS.—A new condensate area for East Texas is indicated in Lone Star Production Co. 1 R. H. Lee, in B. C. Walters Survey, 2½ miles north of Athens, Henderson County. On an 11-minute drill-stem test at 8,198-8,208 ft., with ¼-in. chokes, it blew gas immediately, recovered 900 ft. of water cushion cut with light oil, 180 ft. of free oil and 120 ft. of brackish water. Estimated gravity of oil was between 45 to 55 degrees. This show is in the Bacon lime stringer of the Lower Glen Rose, the producing zone in the Tri-Cities field southwest of Athens. The 1 Lee was coring ahead past 8,235 ft.

The Texas Co. 1 McKnight, Freestone County wildcat which last week showed gas and straw-colored distillate in Travis Peak sand at 8,234-55 ft., cored deeper to 8,293 ft., tried drill-stem test at 8,287-93 ft., blew gas with 1,180-lb. pressure, was unable to close testing pool and after killing well was trying to free stuck pipe.

EAST TEXAS WILDCAT COMPLETIONS

Hunt County: Homer Snowden et al 1 C. W. Gentry, Shelby CSL, A-946, 6 mi. SW Caddo Mills, elev. 526 ft., Woodbine 2,600 ft., dry, TD 3,286 ft.

Panola County: Southern Production Co. 1 A. C. Soape, J. N. Williams Sur., A-712, 4 mi. SW Carthage, elev. 341 ft., lower Pettit porosity 6,061-6,115 ft., Travis Peak 6,290 ft., IP 153,000,000 cu. ft. gas open flow, TD 6,503 ft.

Robertson County: W. H. Doran et al 1 Fogle-Woodall, L. Purdy Sur., 6 mi. NW Calvert, dry, TD 1,644 ft.

PERMIAN BASIN

Possible New Pools Near Slaughter Field

MIDLAND.—Fikes & Murchison 1 Alexander, northwestern Terry County wildcat in Section 18, Block K, PSL Survey, 6 miles southwest of the Slaughter pool, looks like a new discovery. Bottomed at 5,127 ft. in lime, with 7-in. casing seat at 5,088 ft., it had 600 ft. of oil in the hole while cleaning out with cable tools, which were rigged up after hole was drilled to 5,127 ft. with rotary. It has not yet been shot with nitro nor treated with acid.

Honolulu Oil Corp. 1 R. M. Hudson, Cochran County wildcat 2½ miles southwest of the Slaughter field, in Section 9, Block 9, PSL Survey, also appears to be opening a new productive spot. It had 250 ft. of oil in hole at 5,124 ft., increasing to 700 ft. while drilling to 5,145 ft. in lime, then encountered water at total depth 5,153 ft. and hole was plugged back to 5,135 ft. to attempt completion.

In southeastern Winkler County, The Texas Co. 1 Hogg, 1¾ miles northwest of Stanolind's discovery producer in the North Monahans field, flowed 246 bbl. oil in 9 hours after using 1,000 gal. acid through perforations at 6,100-40 ft., opposite Permian lime pay. On the north side of the Keystone-Ellen field, Winkler County, Phillips Petroleum Co. 2 Bash was completed for 1,650 bbl. daily through ½-in. choke from pay through perforations at 9,780-9,840 ft., with total depth 9,951 ft. in granite. Sun Oil Co. 2 Keystone, wildcat 2 miles northwest of same field, was preparing to drill-stem test after drilling and coring the Waddell sand of the Simpson section from 10,085-109 ft., with favorable oil shows. It is the fourth prospective pay zone logged thus far by this wildcat.

In northwestern Ector County, Shell Oil Co., Inc. and Cities Service 1 TXL, which has logged productive pay in basal Permian, Devonian and Silurian beds, showed only sulfur water in the Ellenburger, topped at 9,980 ft., with total depth 10,019 ft. and was plugging back to test the higher pays.

A deep test on east side of the Permian basin, Magnolia Petroleum Co. 22 Mary Foster, in the Iatan-East Howard shallow field, topped Ellenburger at 8,415 ft., had oil stains in first foot of Ellenburger, but recovered only 390 ft. of mud with no shows on drill-stem test at 8,404-17 ft.

(Continued on page 131)

DAILY AVERAGE PRODUCTION FOR WEEK

	Nov. 18 crude oil	Distillate, allied products	November PAW quota all oils	Nov. 11 crude oil
Arkansas	80,450	5,100	83,100	80,750
California	887,250	52,400	937,400	880,250
Colorado	9,500	.....	9,000	9,100
Eastern	67,900	8,200	80,200	68,000
Illinois	189,400	12,200	212,200	204,800
Indiana	12,600	.....	13,000	13,100
Kansas	282,700	6,000	280,000	266,000
Kentucky	30,400	2,800	28,800	30,300
Louisiana	363,550	35,000	385,000	363,150
North Louisiana	72,250	.....	.....	71,850
South Louisiana	291,300	.....	.....	291,300
Michigan	49,800	500	51,000	49,500
Mississippi	52,550	.....	50,000	51,500
Montana	23,600	400	24,400	23,400
Nebraska	1,000	.....	1,000	1,000
New Mexico	104,650	5,500	115,500	104,700
Oklahoma	358,050	26,900	371,900	359,400
Texas	2,132,300	145,000	2,278,000	2,132,300
East Texas	367,900	.....	.....	367,900
East Central Texas	144,600	.....	.....	144,600
North Central Texas	151,200	.....	.....	151,200
Texas Panhandle	94,150	.....	.....	94,150
West Texas	473,950	.....	.....	473,950
South Central (S. A.)	20,150	.....	.....	20,150
South Texas (Laredo)	79,300	.....	.....	79,300
Lower Gulf Coast	247,650	.....	.....	247,650
Upper Gulf Coast	553,400	.....	.....	553,400
Wyoming	90,600	3,400	103,400	94,600
Total United States	4,736,300	303,400	5,023,900	4,731,850
Change from previous week	up 4,450	.....	.....	.....

Total production January 1-November 18, 1944 ..... 1,470,127,900 bbl.
Same period last year ..... 1,313,674,830 bbl.

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CALIFORNIA

West Montebello Field Gets New Deep Pay

LOS ANGELES.—The outstanding event this week was the discovery of a new deeper productive zone in the West Montebello field, in rocks of Miocene age, but it may take another well to definitely determine its potential value. The discovery well, Union Oil Co. 3 Howard & Smith, was recompleted several days ago flowing 189 bbl. of 33.6-gravity oil and 2,423,000 cu. ft. of gas daily from 9,165 ft. This hole was carried to 10,722 ft. where mechanical trouble developed and the hole was plugged back to 9,165 ft. and the 5½-in. casing that had been landed at 10,720 ft. was gun perforated at several intervals.

There was no change in the status of Hasley Canyon, where Shell encountered small production a week or so ago, as the discovery well is being cleaned out. This potential discovery well has been on and off production several times with sand trouble, and it may take another well to determine the field's importance. Hasley Canyon is east by south of the Oak Canyon field in the Newhall-Castaic region.

In the South Coles Levee field, Standard has reached a depth of 15,888 ft. and should reach or pass 16,000 ft. within the next week or 10 days.

CALIFORNIA WILDCAT COMPLETIONS

Belridge outpost well, Kern County: Superior 1 Crocker, 13-27s-21e, dry, TD 4,468 ft.

Cymric outpost well, Kern County: Superior 1 Moor, 15-29s-21e, dry in gray sand, TD 3,360 ft.

Edison outpost well, Kern County: Judy K Oil 1 El Tejon, 22-30s-30e, dry, TD 2,701 ft.

Mount Poso outpost well, Kern County: Aga Oil 9 S.P., 3-27s-28e, dry in gray sand, top grit zone 1,429 ft., top barren Vedder of Miocene age 1,436 ft., TD 1,488 ft.

MICHIGAN

Year's Deepest Test Drilling Below 6,000 Ft.

SAGINAW. — Chamness & Colvin were drilling below 6,000 ft. this week in Michigan's deepest oil test this year on the Roddenberry lease in Section 27 of Salem Township, Washtenaw County. Operations elsewhere in the state saw 16 completions; 4 oil producers, 2 gas wells and 10 dry holes. Four wildcat tests were dry and a fifth wildcat had a moderate flow of gas in Section 12 of Martiny Township, Mecosta County.

Sohio Petroleum Co., completing 5 Cummings in Section 32, flowing 408 bbl. pinched, developed the sixth producer in the expanding Coldwater field of Isabella County. It is a half mile west of the discovery well. A half-dozen other wells are planned at once.

Seventeen drilling permits were issued by the state conservation department, four for the Coldwater field, three for Van Buren County locations, two each for Allegan and Ottawa, others for Gratiot, Kent, Montcalm, Clare, Bay and Ogemaw counties.

MICHIGAN WILDCAT COMPLETIONS

Arenac County, Au Gres Township: W. L. McClanahan 1 Muller, S½ SE SE 11-19n-6E, dry, TD 4,292 ft.

Ionia County, Easton Township: Howard L. Foster 1 Sweet, NE NW SE 6-7n-7w, dry in Monroe, TD 3,075 ft.

Mecosta County, Martiny Township: Michigan Consolidated Gas 1 Evans et al, NW SE SW 12-15n-8w, 613,000 cu. ft. TD 1,390½ ft.

Muskegon County, Dalton Township: Jacob Bolema 1 Kops, NE NE SE 9-11n-16w, dry, TD 1,070 ft.

Osceola County, Sherman Township: Gordon Oil 1 Lakies, SE SE SW 15-20n-9w, dry in Monroe, TD 4,118 ft.

ILLINOIS

Hamilton County Wildcat May Be a Pool Opener

CENTRALIA, Ill.—A 300-bbl. well, Gulf Refining Co. 1 Gaston, SE SE SE 15-1s-4e, Coil West Pool, Jefferson County, was the best of a crop of 29 new oil wells reported during the week in Illinois. The well also produced 93 bbl. of water.

In Hamilton County, Sinclair Wyoming Oil Co. 1 Clyde Russell, a wildcat 4 miles east of Thompsonville, and in SW SE SW 17-7s-5e, in a drill-stem test, developed 3,100 ft. of oil, gas and 40 ft. of oil-cut mud, and no water. It is 3 miles from production.

Forty-six new operations in the state include an even dozen wildcats as follows: Pure Oil 1 C. E. Keith-A, NW NE SW 15-2s-7e, Wayne County; C. E. Brehm et al 1 A. Mary Miller, SW SW NW 26-4s-9e, White County; National Associated Petroleum Corp. 2 Tyler, NW SW NE 33-5s-7e, Hamilton County; W. H. Krohn 1 King, NW NE SE 20-4n-5e; O. A. Oldfield 1 Modlin estate, SW SE SE 35-3n-5e, and Wisconsin Refining Co. et al 1 J. R. Murban, NE SW NE 32-5n-7e, all in Clay County; Hayes & Wolf 1 Cunningham, SW SW SW 32-2n-13w, Wabash County; National Associated 1 J. Kubiak, NE NE NW 24-3s-1e, Jefferson County; The Texas Co. 1 J. N. Huddleston, NW SW NE 13-6n-9e, Jasper County; Sohio 1 R. F. Imbs, NW NE SE 7-4n-6w, Madison County; E. S. Adkins 1 Collins, NW SW NE 34-7s-2e, Franklin County; Swan & Jarvis 1 W. J. Hedges, NW NW NE 17-7s-5e, Hamilton County.

ILLINOIS WILDCAT COMPLETIONS

Bond County: Magnolia 1 L. V. Hunter, NW NW NE 15-6n-3w, dry at 2,386 ft. No log.

Clinton County: Al Schierman et al 2 Jansen, SW NW NE 32-2n-2w, dry at 1,290 ft., Glen Dean 940 ft., Cypress 1,149 ft., Benoist 1,249 ft., Benoist sand 1,280 ft.

Edwards County: National Refining 1 W. L. Reid, NW NE NE 31-1n-10e, dry at 3,419 ft., Glen Dean 2,651 ft., Ste. Genevieve 3,225 ft., Fredonia 3,278 ft. No Benoist or Aux Vases sand recorded.

Bruce Martin 1 Bradham, SE SE SW 3-1n-14w, Levias lime 2,976-81 ft., 80 perforations at 2,970-84 ft., pumped 10 bbl. oil, 50 bbl. water, TD 3,125 ft., PB to 2,990 ft.

Franklin County: E. S. Adkins 1 Old Ben Coal, SW SE SW 15-7s-3e, dry at 3,015 ft., coal 493 ft., upper Kincaid 1,705 ft., Cypress 2,549 ft., Aux Vases 2,813 ft., McClosky 2,985 ft.

Jefferson County: W. J. Lewis 1 Conrad Schul, SE SE NW 9-3s-3e, dry at 2,973 ft., Kincaid 1,796 ft., Cypress 2,480 ft., Benoist 2,658 ft., Aux Vases 2,729 ft., McClosky 2,863 ft.

Lawrence County: B. B. B. Drilling Co. 1-A Charles Rogers, SW SE NE 8-2n-12w, dry at 2,271 ft., McClosky lime 2,259-70 ft.

(Continued on page 131)

WHY PATTERSON STEEL BUILDINGS ARE BETTER

The superiority of Patterson Sectional Steel Buildings is neither an accident nor an incident. It is the result of 23 years' experience in meeting the needs of the oil industry and other industries. They combine broad experience with engineering knowledge, skilled workmanship and modern plant facilities. Among the advantages of Patterson Sectional Steel Buildings are the following:

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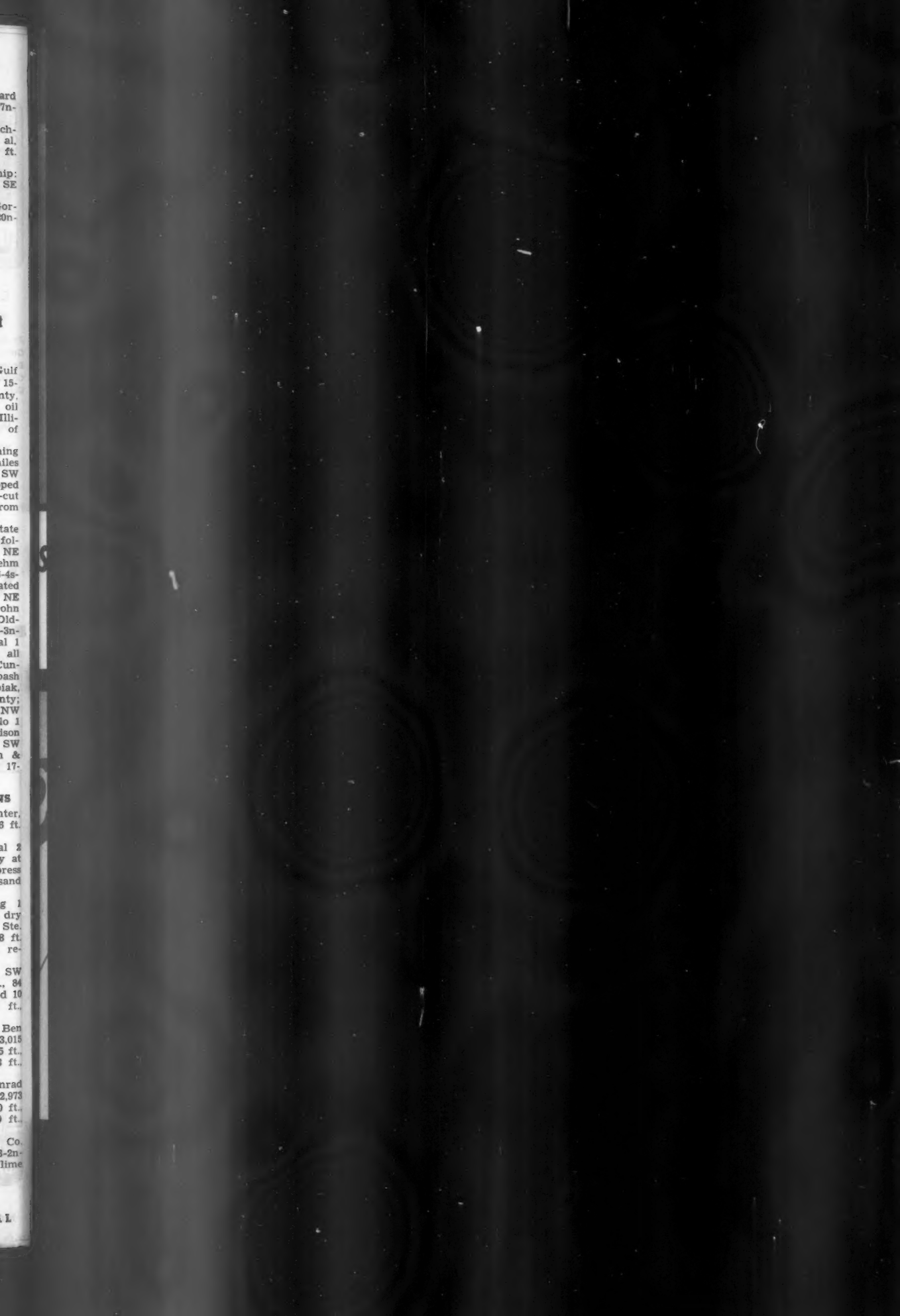

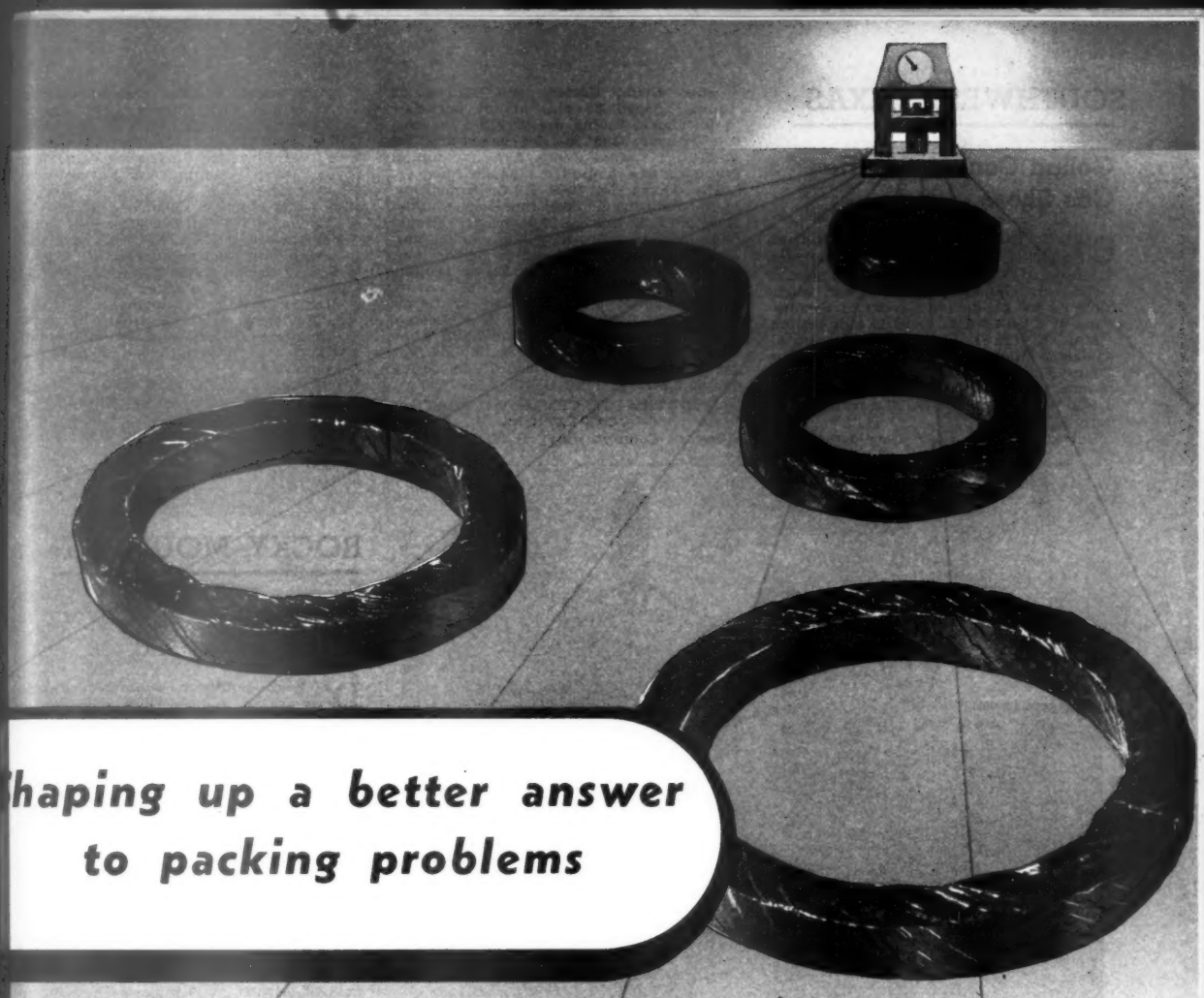

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SOUTHWEST TEXAS

Goliad County Test Has Gas Show

CORPUS CHRISTI.—Amerada Petroleum Co. 1 A. O. McFaddin et al, wildcat, in the Hordes Creek area, 12 miles west of Goliad in Goliad County, tested slight blow of gas on drill-stem test of perforations at 8,480-8,502 ft., and is still testing.

Sun Oil Co. 1 J. G. de Garza et al, wildcat 2 miles north of Sun field in Starr County, recovered 1,930 ft. of oil in a 15-minute drill-stem test at 5,807-25 ft., using ¼-in. chokes, 135-lb. working pressure.

United North & South Development Co. 4 Max Webb, United field, Guadalupe County, gaged 84 bbl. of oil per day, 7/64-in. choke, tubing pressure 225 lb., casing pressure 100 lb., 5½-in. casing set at 2,493 ft., total depth 2,570 ft., top of pay 2,522 ft., completed in open hole.

The Texas Co. 19-B E. L. Armstrong, in the Armstrong field, Jim Hogg County, flowed 128.29 bbl. of 37.6°-gravity oil per day on potential test, ¼-in. choke, gas-oil ratio 2,002 to 1, from 48 perforations at 3,672-80 ft., total depth 3,688 ft. Drilling & Exploration Co., Inc. 1 W. F. Lovett, wildcat, about 8 miles north of Leroy, was dry at 6,289 ft. Killam & McLean 6 Marrs McLean, in the McLean field, Webb County, pumped 20.4 bbl. a day of 55°-gravity oil on potential test, 5½-in. casing set at 3,241 ft., total depth 3,254 ft.

SOUTHWEST TEXAS WILDCAT COMPLETIONS

Atascosa County: Harry S. Stahl 1 Mary Ann Suggs, 6 miles east of Leming, in Simon Fisk Survey 1,171, dry at 1,003 ft.

Goliad County: Barnsdall 1 Alvin Metz et al, 10 miles northwest of Goliad, in James Cunningham Survey, dry at 8,515 ft.

Jim Wells County: Blanco Oil and Al Buchanan 1 Eureka College, 5 mi. northwest of Falfurrias, in Los Olmos and Loma Blanca Ignacia De La Pena grant, dry at 6,868 ft.

Milam County: C. Padger Reed 1 A. L. Lucas et al, 3 mi. northeast of Rockdale, near Minerva field, in T. J. Chambers 2-League grant, total depth 1,393 ft., potential test 5 bbl. day pumping.

Webb County: O. W. Killam 3 E. Garcia heirs, 5 mi. southeast of Mirando City, in Survey 609, dry at 3,200 ft.

Zapata County: Bridwell Oil Co. 1 Maria T. G. Garcia et al, 20 mi. east of Zapata, in Charco Redondo grant, dry at 1,816 ft.

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ROCKY MOUNTAIN

Morrison Sand Discovery In Dry Creek Field

DENVER.—Southern Montana has a discovery in the Morrison sand in the Dry Creek field, Carbon County, 15 miles to the northwest of the Elk Basin field, in Ohio Oil Co. 18 Northern Pacific, in NE NE SW 3-7s-21e. Through 96 holes in the 5½-in. casing at 5,905-45 ft. it averaged 300 bbl. per day on a 5-day pumping test, the oil being light with a gravity of approximately 50°.

The discovery well was a deep test and drilled to a total depth of 8,882 ft. Madison was logged at 7,170 ft. The results in the 1,712 ft. drilled below the top of that horizon were not released by the operator. It was unofficially reported, however, that it had the Jefferson lime at 8,125-8,420 ft., showing some saturation at 8,340-8,420 ft., but this was never confirmed.

Dry hole at Little Buffalo Basin.—Trigood Oil Co. 1 Jones, in SW NW NE 7-47n-99w, Little Buffalo Basin, Park County, Wyoming, the fourth well drilled to the Tensleep since a discovery was made in that horizon late in 1943, had the top of the formation at 5,238 ft., and was dry at 5,410 ft. It was located a mile to the east of the three producers which run in a north-south line and 4 miles southeast of the Stanolind Oil & Gas Co.'s 1 Unit which was dry at 5,776 ft.

Powder Wash oil horizon extended.—Mountain Fuel Supply Co. 2 Hal Stewart, in SE SE NE 32-12n-97w, Powder Wash gas field, northern Moffat County, Colorado, is being completed as an oil well in a 60-ft. sand in the Wasatch formation topped at 5,150 ft. It is estimated at 20 bbl. an hour along with approximately 5,000,000 cu. ft. of gas. A 45-ft. sand topped at 4,020 ft. was estimated at better than 8,000,000 cu. ft. of gas per day.

Show for discovery at Clark's Fork.—General Petroleum Corp. 1 Government, in C NW NW 25-9s-22e, Clark's Fork structure, Carbon County, Montana, topped the second Frontier at 6,160 ft., and cores showed oil saturation. Drill-stem test at 6,457-90 ft., open 30 minutes, recovered 66 ft. of gas-cut mud when the packer failed to hold. It looks as though it will make some kind of a well. The hole will be cored a little deeper and casing will be run. Then rig will be moved away for the winter.

Water in Shawnee in Sundance.—Cores taken in upper Sundance at 3,701-20 and in basal Sundance at 3,869-88 ft. in Dickey Oil Co. 1 Government, in C NE SW 27-

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32n-69w, Shawnee district, Converse County, Wyoming, showed water.

WYOMING WILDCAT COMPLETIONS

Niobrara County, Little Buck Creek: Continental 1 Barrett, SE SW SW 24-35n-64w, TD 4,086 ft., 7-in. 4,078 ft., tested water in all benches of Dakota and Lakota, dry.

Park County, Little Buffalo Basin: Trigood Oil 1 Jones, SW NW NE 7-47n-99w, TD 5,410 ft., top of Tensleep 5,238 ft., dry.

MONTANA WILDCAT COMPLETIONS

Carbon County, Dry Creek: Ohio Oil 18 Northern Pacific, NE NE SW 3-7s-21e, TD 8,882 ft., PB to 6,000 ft. and completed in Morrison sand for 300 bbl. per day pumping, through perforations 96 holes at 5,905-45 ft. Tops: Morrison, 5,905; Sundance, 6,050; Embar, 6,858; Tensleep, 6,870; Amsden, 6,985; Madison, 7,170; 6½-in. 8,265 ft., rot. table elevation 4,552 ft.

SOUTH LOUISIANA

Plaquemines Parish Gets Two Good Completions

NEW ORLEANS.—Phillips Petroleum Co. 9 LLE-fee, 44-20s-28e, at Bastian Bay field in Plaquemines Parish, gaged 205 bbl. daily on ⅛-in. choke flowing from perforations 9,158-61 ft. Total depth is 9,250 ft., with 5½-in. casing set at 9,229 ft. It showed tubing pressure 1,750 lb., gas-oil ratio 600 to 1, gravity 34.9, 0.1 per cent water.

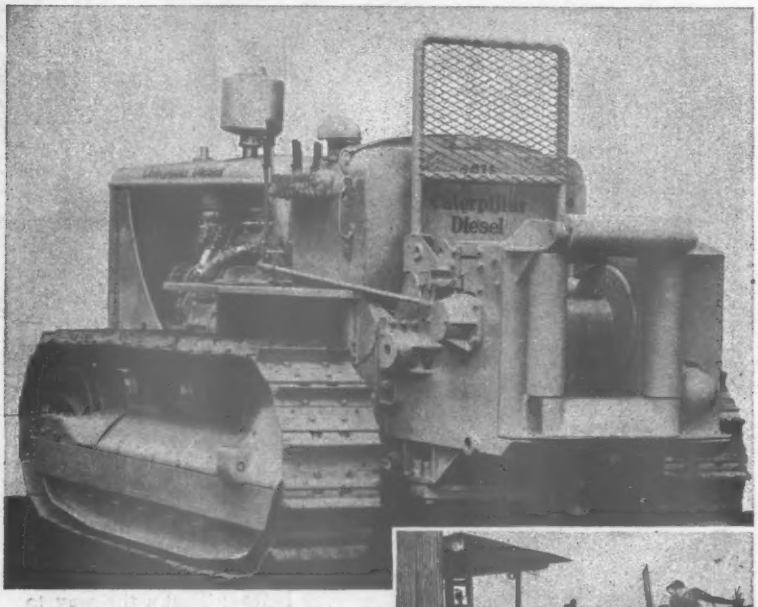
Gulf Refining Co. 10 State-West Bay PP, in 35-22s-30e, at West Bay field in Plaquemines Parish, completed from perforations at 9,252-58 ft., flowing 365 bbl. per day on 9/64-in. choke, gas-oil ratio 822 to 1, tubing pressure 2,500 lb., gravity 32.1, 0.2 per cent water. Total depth is 11,200 ft., with 5½-in. casing set at 10,978 ft. This well had been brought in several weeks ago from perforations at 10,888-92 ft., in a new sand for the field, flowing 390 bbl. per day through 5/32-in. choke, gas-oil ratio 6,355 to 1, gravity 30, tubing pressure 5,450 lb., but it was reworked and completed in the 9,250-ft. sand.

Humble Oil & Refining Co. 1 I. R. Price, 26-16s-22e, Delta Farms field in La Fourche Parish, is completing from perforations at 9,413-24 ft., flowing 5.5 bbl. per hour through 5/32-in. choke, gravity 36.5. Total depth is 9,490 ft., with 7-in. casing set at 9,478 ft.

SOUTH LOUISIANA WILDCAT COMPLETIONS

Calcasieu Parish: Continental 1 Glen Greathouse et al, discovery South Lake Charles area, 5 mi. east of East Moss Lake field, Sec. 9-11s-8w. Total depth 11,019 ft., perforated 10,018-26 ft., potential test 130 bbl. day 52.9°-gravity through 11/64-in. choke with 1,639,000 cu. ft. gas. Shut-in tubing pressure 3,300 lb.

Cameron Parish: Stanolind 1 Jos. Bishop, Creole area, Sec. 5-15s-8w, dry at 8,930 ft.



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OHIO, KENTUCKY

Huntington Gas Field Gets West Extension

COLUMBUS.—The fourth gas well, with an initial open flow of 9,310,000 cu. ft., extended the new Huntington pool in Lorain County a location to the west. The completion, Ohio Fuel 1 U. A. Leonard, Tract 6, had 11 ft. of Clinton sand at 2,409-20 ft.

The South Lakeville pool was extended a location to south by the Ohio Fuel 1 Clark Miller, Section 11, Washington Township, Holmes County. The Clinton sand at 3,070-3,122 ft. was shot and the shut-in potential was rated at 1,230,000 cu. ft.

OHIO WILDCAT COMPLETIONS

Cochocton County, Mill Creek Township: Ohio Fuel 1 Nathan Bechtol, Lot 2, Berea 1,039-1,064 ft., dry, TD 1,090 ft.

Medina County, Chatham Township: Edson & Son 1-C Ray Koons, Lot 21, Clinton 3,015-3,018 ft., dry, TD 3,085 ft.

EASTERN KENTUCKY

ASHLAND.—One oil well was listed in the reports from the various fields in Eastern Kentucky during the week. A dry hole was reported but other completions were at the zero point.

WESTERN KENTUCKY

OWENSBORO, Ky.—W. F. Lacy 1 T. T. Williams, 4-Q-20, Henderson County, south of Mount Vernon, Ind., and 2½ miles from production was being made ready for a production test after a good showing in a drill-stem test of Aux Vases sand at 3,120-39 ft.

Chenault, Farmer and Basin Drilling Co. 1 Slaton, 17-M-19, Union County wildcat, is producing oil from the Hardinsburg sand, at 1,347-60½ ft. It pumps 18 bbl. per day. The well is 2 miles south of the town of Sturgis and 12 miles from other production.

WESTERN KENTUCKY WILDCAT COMPLETIONS

Webster County: Ashland 1 Boyd Busby, SW SW SE 17-M-19, dry at 2,753 ft., lower Glen Dean 2,003-15 ft., Barlow 2,244-48 ft., Renault 2,443-84 ft., Ste. Genevieve 2,615 ft., St. Louis 2,662 ft.

George Knoll and B. Stanislawski 1 Low Moisture Coal Co., 2 mi. E of Clay, dry at 1,985 ft.

Union County: Walters, Hodges and Bla-

lack 1 Sam Clents, 25-P-20, Cypress sand 2,287-95 ft., TD 2,295 ft., pumped 160 bbl. in 24 hours.

Kirk D. Holland 1 William Pollard, NE NE NE 25-P-NE, dry at 2,675 ft., through Cypress sand.

INDIANA

EVANSVILLE, Ind.—A 40-bbl. well in the South New Harmony field in Posey County and five dry holes in Huntington, Owen, Vanderburgh, Wabash and Wells counties, make up the completion record of the week in Indiana.

INDIANA WILDCAT COMPLETION

Owen County: Texas 1 Nugent, SE NE SW 3-9n-5w, dry at 2,593 ft., Devonian lime top 1,414 ft., Trenton 2,397 ft.

APPALACHIAN FIELD

United Fuel Gas Extends Old Pool Eastward

PITTSBURGH.—In Cabin Creek district, Kanawha County, West Virginia, United Fuel Gas Co. extended its old pool eastward with completion of 5,476 Imperial Coal Co. in the Weir sand and a gage of 1,161,000 cu. ft. gas. The Big Lime was topped at 2,295 ft., Injun 2,510 ft., and total depth 3,078 ft.

In Jefferson district, Nicholas County, 6 C. C. Dickinson completed by Columbian Carbon Co., was good for 4,115,000 cu. ft. gas after acidizing the Big Lime with 1,000 gal. The gas was found in the Big Lime at 1,440-49 ft. and a larger pay at 1,506 ft. with total depth of 1,508 ft. This completion is the largest well in the new pool.

In Lewis County, Hope Natural Gas Co. completed drilling the Oriskany test on J. L. J. Bailey farm in Freemans Creek district at 7,022 ft., with the Oriskany sand placed at 6,914-7,018 ft. and a final open flow of 78,000 cu. ft. gas. The test will be shot this week.

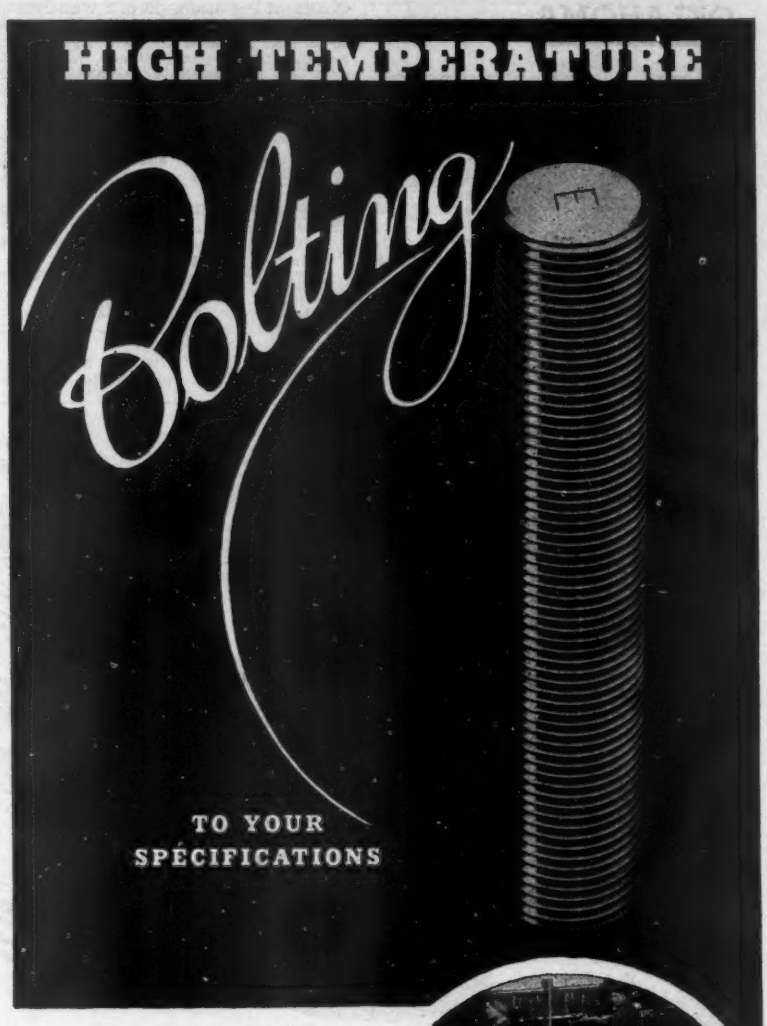
On Chestnut Ridge in Wharton Township, Fayette County, Grennsboro Gas Co. is assured of a gas well in 5 Barton with a gage of 556,000 cup. ft. in the Onondaga chert at 7,073 ft.

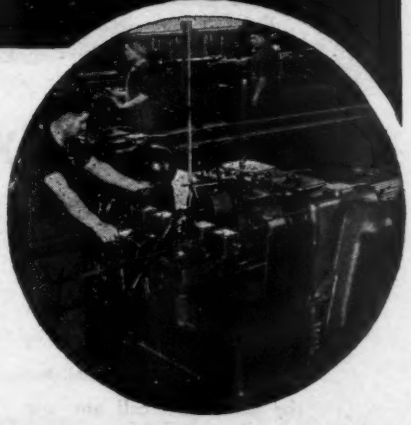
CANADIAN FIELDS

Three Tests Completed In Turner Valley

CHATHAM.—Three new tests, assisted by the government-financed Wartime Oils, have been completed in West Central Turner Valley. They are Pacific Petroleums 7, LSD 11, 25-19-3w5, total depth 7,440 ft., Madison 7,220 ft., 78 bbl. daily of 39.8° gravity oil with 154,000 cu. ft. gas; Okalta Oils 17, LSD 9, 24-19-3w5, Madison 7,388-7,633 ft., 405 bbl. daily of 40°-gravity oil with 608,000 cu. ft. gas, and Okalta Oils 19, LSD 14, 18-19-2w5. Madison 6,969-7,219 ft., 252 bbl. daily 40°-gravity oil with 450,000 cu. ft. gas.

Steveville.—Most important development in Alberta since Turner Valley, California-Standard-Princess 8, LSD 16, 21-20-12w4, with Devonian at 3,923-82 ft. produced 315 bbl. daily of 35° gravity crude through ¼-in. choke. Following the strike, the first large Devonian production in Alberta, California Standard is planning additional drilling, while other groups are undertaking Devonian tests in the same area. Definite testing of this formation is under way in many parts of Alberta, including the Ram River field west of Rocky Mountain House; and, in southern Alberta, the Taber and Twin River fields.





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OKLAHOMA

W. Edmond May Get 3-Mile North Extension

INTEREST in Oklahoma was centered on Phillips Petroleum and Carter Oil Co. 1 Dublin, NE NE 18-15n-4w, Logan County, which may give the West Edmond field a 3-mile north extension. Latest available drilling depth was 6,806 ft., with geologists figuring the Bois d'Arc pay due at 6,815-20 ft., based on normal interval from the Woodford along the strike. Pipeline runs for the week were 45,100 bbl. daily from 228 connected wells.

South Moore.—Three completions were registered this week in the South Moore pool, the first since its discovery. Mid-Continent Petroleum Corp. 2 Westermeier, north offset to the discovery, NE SW NW 26-10n-3w, is rated as good for 200 bbl. per day from second Wilcox, total depth 8,968 ft. Helmerich & Payne and Mid-Continent 1 Brand, NE NE SW 26-10n-3w, missed the Wilcox and is going on down to test the Arbuckle. Barnsdall Oil and Sohio Petroleum Co. 1 Molleman, NE SE SE 27-10n-3w, had about 3 ft. of dry Wilcox sand and was shut down for orders.

OKLAHOMA WILDCAT COMPLETIONS

Carter County: H. F. Gibson 1 Adams, NW NW NW 10-5s-1w, dry, TD 4,715 ft., Chubby sand 3,560 ft.

H. F. Gibson 1 Sarasota, NW SW SW 4-5s-1w, dry, TD 4,620 ft.

Garvin County: Ed J. Kubat 1 Newbern, NE NE SW 18-4n-2e, dry, TD 4,130 ft., Bromide 4,098 ft.

Phillips 1 Bessie, SW SW SW 8-3n-2e, flowed 117 bbl. and no water from pay zone 3,048-3,197 ft., gravity 33.7°, TD 3,197 ft., Pennsylvania sand 3,093 ft., Viola 3,170-97 ft.

Sinclair Prairie 1 Wright, SE SW NE 20-3n-3e, dry, TD 2,291 ft., Simpson dolomite 1,856 ft.

Grady County: Olson Drilling et al 1 Pfile et al, SE NE NE 32-3n-7w, dry, 3,512 ft.

Glitach & Sons 1 Allen, NE NW NW 9-7s-7w, dry, TD 2,320 ft.

Greer County: McLennan 1 McLeod, SW SW NW NW 32-6n-21w, dry, TD 668 ft., granite wash 614 ft.

Hughes County: Deep Rock 1 Bailey, NE NW NE 20-7n-11e, dry, TD 5,500 ft., second Wilcox 5,440 ft.

Jefferson County: Bridwell Oil 1 Trout "D," NW NW SE 3-7s-6w, dry, TD 2,424 ft.

Logan County: Fox & Fox 1 Tontz, NE NE 32-17n-3w, dry, TD 6,448 ft., second Wilcox 6,376 ft.

Okfuskee County: Kewanee 1 Marshall Comm., SE NW SW 1-10n-8e, pumped 80 bbl. plus water from pay zone 3,968-91 ft., TD 4,051 ft., Booch 3,081 ft., Cromwell 3,473 ft., Woodford 3,965 ft., Hunton 3,985 ft.

Pawnee County: Johnson Oil & Refining 1 Bryson, SW SW 23-21n-5e, dry, TD 3,304 ft., Bartlesville 3,160 ft.

Keener 1 Maitlen, NW NE NE 17-23n-3e, dry, TD 4,137 ft., second Wilcox 4,118 ft.

Payne County: Parker-Duerr Drilling 1 Maroney, NE NE SE 1-18n-2e, dry, TD 4,692 ft., second Wilcox 4,678 ft.

Raddock & Dirickson 1 Nelson, NW NW NE 33-18n-3e, dry, TD 4,695 ft., second Wilcox 4,680 ft.

Pottawatomie County: Cities Service 1 Harbour, NE NE NW 13-9n-2e, pumped 43 bbl. from pay zone 4,914-63 ft., TD 5,798 ft., Earlsboro sand 4,946 ft.

Seminole County: Monahan 1 Kennedy, SE SE SE 19-11n-8e, dry, TD 3,724 ft., Cromwell 3,655 ft.

Stephens County: Phillips 1 Blundell, NE SW NE 10-1n-5w, flowed 358 bbl. in 24 hours, gravity 41°, from an unnamed sand at 5,540-5,617 ft., TD 5,617 ft.

Bergance & Shine 1 Poe (Boring), SW SW NE 7-3s-4w, dry, TD 2,410 ft.

Kerlyn 1 School Land, SE SE NW 36-1s-9w, dry, TD 2,820 ft.

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MISSISSIPPI

Two Flows of Low Gravity Oil By Lamar Co. Test

JACKSON.—Gulf Refining Co. 1 Cooper, NE NW 7-1n-16w, Lamar County wildcat, the most closely watched well in Mississippi, perforated and made two drill-stem tests in the Massive sand. First test at 8,690-8,714 ft., resulted in a flow of 151 bbl. of 17° gravity oil in 7 hours. The second test at 8,734-44 ft., with upper perforations packed off, brought a flow of 27 bbl. per hour of 13.5° gravity oil.

MISSISSIPPI WILDCAT COMPLETIONS

Copiah County: J. B. White et al 1 Magnolia Textiles, SE SE 8-9n-7e, dry, TD 10,226 ft., base Austin 8,900 ft.

Hinds County: J. B. Canterbury 1 Ball, NW SE 7-5n-1w, dry, TD 6,150 ft., Tuscaloosa 4,725 ft.

Washington County: Placid 1 Cooper, approx. N½ SE SE 7-14n-9w, dry, TD 6,677 ft.

ARKANSAS WILDCAT COMPLETIONS

Ashley County: Union Products E-1 Crossett, approx. NW SW 12-19s-7w, dry, TD 11,136 ft.

NORTH LOUISIANA WILDCAT COMPLETIONS

Catahoula Parish: Sinclair Prairie 1 Fisher, NE SW 26-9n-6e, dry, TD 5,814 ft.

Grant Parish: Calapor Manufacturing 1 Edenborn, approx. SE NW SE 20-7n-3w, dry, TD 4,530 ft.

TEXAS GULF COAST

New Pool Opener For Wharton County

HOUSTON.—General Crude Oil Co. has opened new oil production in Wharton County, at 2 Security Bank & Trust Co., 4 miles southwest of Lane City, in S. Castleman Survey 5. Completion is being made through perforations at 5,345-50 ft. On preliminary test it flowed 4 bbl. per hour through ⅛-in. choke, tubing pressure 1,050 lb., gravity 26.1°. Operator is now setting screen to run new production test. Total depth is 5,727 ft., with 5½-in. casing set at 5,550 ft.

Skelly Oil Co. opened new gas-condensate production in Matagorda County at 1 Granbury-Fullilove, 3 miles northeast of Van Vleck in Amos Rawls Survey. Total depth is 10,010 ft., with 5½-in. casing set at 8,854 ft. and it has been testing at various levels prior to completion. Final perforations were at 8,739-47 ft., and the well flowed 356,000 cu. ft. of gas and 7 bbl. of 51° gravity condensate through ¼-in. choke, in 4 hours, tubing pressure 2,150 lb. flowing.

Humble Oil & Refining Co. 1-C Jefferson Land Co., in Shelby Corzine Survey, Abstract 14, on northeast edge of Lovell Lake field in Jefferson County, is classified as a new field discovery by the company, as it is 3,600 ft. north of nearest wells in the Lovell Lake field. The new producer flows from the 7,200-ft. level while field wells produce from the 7,700-ft. level. The test showed a potential of 86.49 bbl. per day on ⅛-in. choke, gas-oil ratio 4,440 to 1, from 22 perforations at 7,176-80 ft., tubing pressure 2,075 lb., casing pressure 2,750 lb., gravity 28.9°, no water. It had been drilled as a deep test, total depth 9,963 ft., plugged back at 7,211 ft. for completion.

Sun Oil Co. opened new production in the Sour Lake area of Hardin County at 1 Merchants estate about 3 miles west of Sour Lake. After reperforating pipe with 58 shots from 6,335-65 ft., the well flowed 112 bbl. in 14 hours, through ¼-in. choke, tubing pressure 200-290 lb.

Gulf Oil Corp. 11 Invincible Oil Co., Thomas Hobermacher Survey, which extends production on southwest flank at Blue Ridge field in Fort Bend County, flowed potential of 52 bbl. per day through a ⅛-in. choke, tubing pressure 300 lb., gravity 38.4°. Total depth 4,300 ft., top sand 4,158 ft., with 5½-in. set at 4,288 ft., perforations 4,158-70 ft.

UPPER GULF COAST WILDCAT COMPLETIONS

Chambers County: Sinclair Prairie 1 G. R. Bauer, T&NO Survey, Abstract 502, 4 mi. northwest of Winnie, dry at 9,619 ft.

Jefferson County: Humble 1-C Jefferson Land Co., North Lovell Lake discovery, in Shelby Corzine Survey, Abstract 14, 3,600 ft. north of nearest 7,700-ft. sand well, total depth 9,963 ft., plugged back 7,211 ft., PT 86.49 bbl. day ⅛-in. choke, gas-oil ratio 4,440 to 1, gravity 28.9°, no water.

Liberty County: Phillips 1 Joe and Mary Ardoin et al, H&TB Survey, Abstract 960, 4 mi. southeast of Felicia, dry at 8,750 ft.

San Jacinto County: Albert Plummer 1 W. J. Settegast heirs, James Hurt Survey, Abstract 161, 12 miles northeast of Willis, dry at 9,038 ft.

Tyler County: American Republics Corp. and Houston Oil Co. of Texas 1 J. S. and Wm. Rice, BBB&C Survey 9, 7½ mi. southeast of Hillister, 6 mi. southwest of Spurger, dry at 8,295 ft.

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Summary of Wildcat Completions

	Comp.	Oil	Prod.	Gas	Dry	Under 1,000 ft.	1,000-2,500 ft.	2,500-5,000 ft.	5,000-10,000 ft.	Over 10,000 ft.	Total footage	Rigs and drilling
N. Y., Penna., W. Va.	558	251	610	77	†230	55	464	39	0	0	793,996	538
Ohio	114	22	553	44	48	16	43	52	3	0	279,339	199
Indiana	32	17	1,572	0	15	5	18	9	0	0	60,235	43
Kentucky	102	37	7,556	25	40	9	73	20	0	0	190,062	101
Michigan	66	20	5,706	5	41	2	28	36	0	0	167,232	145
Illinois	176	106	11,606	0	68	2	56	118	0	0	457,899	269
Kansas	151	60	29,120	9	82	0	11	136	4	0	515,176	276
Mo., Iowa, Neb.	3	1	30	0	2	2	1	0	0	0	2,587	7
Oklahoma	173	109	48,368	15	49	5	42	61	65	0	728,945	547
Texas:												
North Texas	94	49	15,004	0	45	16	29	29	20	0	375,703	109
West Central Texas	33	11	2,956	0	22	1	10	20	2	0	95,234	49
West Texas	130	109	64,742	0	21	0	6	81	40	3	808,779	459
Texas Panhandle	35	28	4,588	4	3	0	0	34	1	0	114,621	212
Eastern Texas	24	12	1,165	5	7	0	1	4	19	0	160,480	97
Upper Gulf Coast	64	41	11,159	5	18	0	3	8	45	8	425,051	121
Lower Gulf Coast	47	33	5,296	7	7	0	0	5	42	0	303,447	104
S. C. Texas (San Antonio)	38	12	1,236	2	24	1	9	16	11	1	164,515	63
South Texas (Laredo)	7	3	200	0	4	0	2	1	4	0	36,001	18
Total Texas	472	296	106,340	23	151	18	60	198	184	12	2,383,821	1,232
Louisiana:												
North Louisiana	32	12	1,555	10	10	0	14	8	10	0	135,879	70
South Louisiana	32	21	4,574	1	10	0	1	1	17	13	278,945	102
Total Louisiana	64	33	6,129	11	20	0	15	9	27	13	414,824	172
Arkansas	16	10	1,307	0	6	0	3	5	8	0	89,139	38
Mississippi	13	7	1,604	0	6	0	0	6	7	0	67,872	73
Ala., Ga., Florida	2	0	0	0	2	0	0	0	2	0	13,997	16
Montana	33	21	2,908	1	11	0	20	13	0	0	75,865	125
Wyoming	19	16	6,969	2	1	1	0	12	6	0	87,192	102
Colorado	1	0	0	0	1	0	1	0	0	0	2,035	36
New Mexico	39	30	3,169	1	8	3	8	22	6	0	128,493	119
California	183	154	30,762	2	27	7	41	102	31	2	666,254	281
Total October	2,217	1,194	264,331	215	†808	125	384	838	343	27	7,124,953	4,319
Total September	2,520	1,357	302,956	289	‡874	162	936	987	403	32	8,119,410	4,340

*Four weeks ending October 28. †Includes 220 service wells. ‡Includes 184 service wells.

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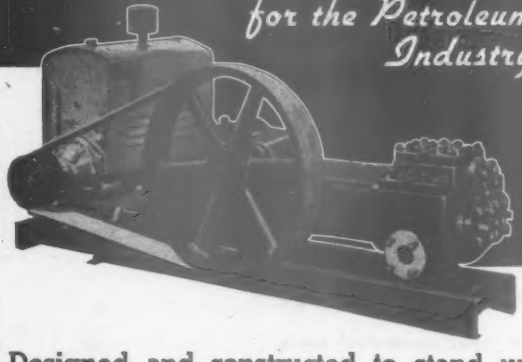

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WILDCAT COMPLETIONS AND DISCOVERIES

	Week ended Nov. 18, 1944					Cumulative total, 1944				
	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ohio	0	0	0	1	1	2	0	17	62	81
Indiana	0	0	0	1	1	4	0	0	22	26
Illinois	2	0	0	13	15	33	0	0	295	328
Kentucky	1	0	0	3	4	16	0	0	77	92
Michigan	0	0	1	4	5	12	0	4	218	234
Kansas	2	0	0	13	15	48	0	9	394	451
Neb., Mo., Iowa	0	0	0	0	0	1	0	0	15	16
Oklahoma	4	0	0	17	21	68	1	20	253	342
Texas:										
North Central	1	0	0	12	13	59	0	1	282	342
West	0	0	0	3	3	40	0	3	162	205
Panhandle	0	0	0	0	0	0	0	2	9	11
Eastern	0	0	1	2	3	5	0	5	113	123
Gulf Coast	1	0	0	6	7	32	12	14	208	266
Southwest	1	0	0	3	4	22	4	15	211	252
Total Texas	3	0	1	26	30	158	16	40	985	1,199
Louisiana:										
Northern	0	0	0	2	2	5	2	2	54	63
Southern	1	0	0	1	2	10	6	1	43	60
Total Louisiana	1	0	0	3	4	15	8	3	97	123
Arkansas	0	0	0	1	1	2	1	0	53	56
Mississippi	0	0	0	3	3	3	0	0	62	65
Ala., Ga., Florida	0	0	0	0	0	2	0	0	27	29
Montana	1	0	0	0	1	4	0	4	43	51
Wyoming	0	0	0	2	2	17	0	2	21	40
Colorado-Utah	0	0	0	0	0	3	0	1	25	29
New Mexico	0	0	0	2	2	7	0	3	50	60
California	0	0	0	4	4	6	0	8	168	182
Total United States	14	0	2	93	109	401	26	111	2,867	3,404
Total previous week	11	2	2	64	79					

KANSAS

Wildcatters Have a Good Week

KANSAS operations were highlighted this week by discovery of a new oil pool, two oil pool extensions, and a new gas well. Phillips Petroleum Co. 1 Vivian, NE NE SE 12-23-12w, 2 miles south of the Richardson pool, in Stafford County, has opened the new Brock pool, with a potential of 330 bbl. per day from the Arbuckle at 3,679-84 ft.

The Kraft-Prusa pool in Barton County was extended to the north by Phil-Han Oil Co. 1 Esfeld, NW NW NW 7-16-11w. At 3,311 ft. 2,500 ft. of oil rose in the hole in four hours, from the Arbuckle. Testing is under way.

W. P. Faulkner 1 Hullman, NE NW NE 11-22-13w, may be giving Drach pool, in Stafford County, a north extension. A very good saturated core was recovered at 3,741-46 ft. in the Arbuckle.

Meade County has been given a gas well by Stanolind Oil & Gas Co. 1 Adams, SW SW SW 8-35-30w. The well showed for 4,000,000 cu. ft. gas with no oil on a drill-stem test at 5,894 ft. Mississippi lime was topped at 5,861 ft.

KANSAS WILDCAT COMPLETIONS

Barber County: J. M. Huber 1 Buck, SW NE SW 35-30-14w, dry, TD 4,696 ft., Arbuckle 4,684 ft.

Barton County: Bridgeport 1 Liebl, NE NE NW 16-18-11w, dry, TD 3,133 ft., Kansas City 3,071 ft.

Butler County: Marlyn 1 Doyle, SE SE NW 22-29-5e, dry, TD 2,841 ft., Mississippi lime 2,383 ft.

Graham County: Sunray 1 Dunwoody, SE SE SW 2-8-22w, dry, TD 3,731 ft., Arbuckle 3,690 ft.

Skelly 1 Davis, NW NW NW 15-7-22w, physical potential 518 bbl. per day from pay zone 3,518-24 ft., gravity 39.2°, TD 3,854 ft., Lansing 3,518 ft., Kansas City 3,522 ft., sandy conglomerate 3,811 ft., cherty conglomerate 3,831 ft., Arbuckle 3,841 ft.

Greenwood County: Producers Supply 1 Maes, SE SE NW 2-27-9e, dry, TD 2,640 ft., Arbuckle 2,634 ft.

J. E. Morris et al 1 Fisher, SE SE NE 31-24-10e, dry, TD 2,385 ft., Mississippi lime 2,294 ft.

(Continued on page 133)

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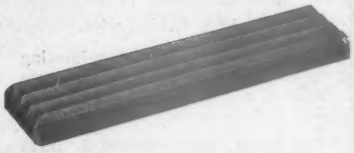

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SEE COMPOSITE CATALOG
PAGES 3101 TO 3120

WEB WILSON
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Among the Drilling Contractors

Penrod Drilling Co. is the contractor on the Hassie Hunt Trustee 1 R. Batson, in C NE SW 10-1s-14w, Pearl River County, Mississippi.

Fisher Drilling Co., as contractor of the test, was preparing to spud on the Southern Natural Gas Co. 1 Gammil Investment Co., in 5-9n-4w, Yazoo County, Mississippi.

Duncan & Porter, drilling contractors, will drill the Southern Natural Gas Co. 1 Fannie Stokes, a 6,500-ft. wildcat test in C SW NW 32-12n-5e, Wilcox County, Alabama.

P. D. Lynch, drilling contractor of Effingham, Ill., was moving in heavy rig to drill on contract the Ilco Corp. 1 Hunsicker, in C NW SE 25-14n-5w, Logan County, Oklahoma.

B. & R. Drilling Co. has the contract to drill the Ira Keith 1 Wendel, in SE SE SE 24-21-19w, in the central part of Pawnee County, Oklahoma, which was drilling below 3,000 ft. Vickers Petroleum Co. and Virginia Drilling Co. are supporting the test.

Olson Drilling Co. has the drilling contract on the Ramsey Petroleum Co. 2 McDowell, in SW NE SE 13-3n-1e, Garvin County, Oklahoma. This is an offset to the recently reworked 1 McDowell, which made a good producer after acidization.

J. E. Trigg was moving in on his contract at the Sinclair Prairie Oil & Gas Co. 1 Rott, in NW SE SE 1-14n-9w, Canadian County, Oklahoma. The test is about 13 miles northwest of El Reno.

General Petroleums, of Calgary, Alta., has finished Great Bend Oils 2, LSD 2, 29-50-5w4, at 1,793 ft., with a flush production of 120 bbl., one of the largest completions in the Vermilion field, eastern Alberta. The same contractors are now completing Great Bend 1, LSD 4, 28-52-3w4, a potential northwesterly extension of the Vermilion production.

Frank Salter, of Edmonton, Alta., is installing machinery for Arrow-Brazeau 1, LSD 5, 9-41-15w4, on the Brazeau structure in the northern Alberta foothills. Salter also has

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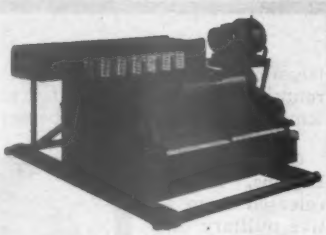

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charge of completion of Ram River Oils 3, LSD 12, 1-37-11w5, which is nearing completion in the Ram River field.

Illinois Fields

(Continued from page 120)

M. B. Sigel et al 1 Woodyard, SW SW NW 10-2n-12w, dry at 600 ft. No log.

McDonough County: Northern Ordnance 1 O. L. Deems, SW SW NW 26-7n-4w, of fourth principal meridian, dry at 760 ft., Devonian 622 ft., Maquoketa 755 ft. (drillers' tops).

Macoupin County: J. Q. Gill 1 Howard Wilson, NW SW SE 29-10n-7w, Penn sand 462-69 ft., shot with 4 qt., pumped 8 bbl. of oil, TD 469 ft.

Montgomery County: Walter Vette 1 Ware, NE NE NW 15-9n-4w, dry at 1,000 ft., top of Pottsville 600 ft.

Wayne County: Aetna 1 French, SW SE SE 15-1n-9e, dry at 3,406 ft., Menard 2,452 ft., Cypress 2,978 ft., Benoist 3,085 ft., Aux Vases 3,195 ft., McClosky 3,300 ft.

White County: B. M. Heath et al 1 Delap, SW SE SE 6-7s-8e, dry at 3,234 ft., upper Kincaid 1,817 ft., Cypress 2,718 ft., Weiler 2,747 ft., Aux Vases 3,012 ft., McClosky 3,084 ft.

Superior 1 F. E. Puckett, NE NW SW 23-3s-8e, dry at 3,583 ft., upper Kincaid 2,249 ft., Cypress 3,109 ft., Benoist 3,257 ft., Aux Vases 3,391 ft., McClosky 3,485 ft.

Will County: M. L. Livingood 1 Herren, NE NE NE 23-36n-9e, dry at 1,958 ft. No log.

Permian Basin

(Continued from page 118)

was coring ahead in dry dolomite at 8,430 ft.

WEST TEXAS WILDCAT COMPLETIONS

Andrews County: Champlin Refining 1-B University, Sec. 5, Blk. 11, University lands, 19 mi. SW Andrews, elev. 3,338 ft., Fullerton 6,645 ft., Detrital 8,050 ft., dry, TD 8,536 ft.

Concho County: Anzac Oil 1 G. R. White, Sec. 4, J. H. Huey Sur., No. 4, 1 mi. SE Lightner, elev. 1,938 ft., dry, TD 1,808 ft.

Pecos County: Milton Unger 1-A Bennett, Sec. 60, Blk. 10, H&GN Sur., elev 2,453 ft., dry, TD 1,694 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—Humble Oil & Refining Co. is starting a new 10,000-ft. test, 2 Federal-Leonard Oil Co., in SW NE Section 13-26-37, southeast of the new deep Ellenburger discovery. Humble 1 Federal-Keinath, east of the Eunice area, was drilling below 9,228 ft. in shale. Ohio Oil Co. is reported planning to start an Ellenburger wildcat shortly on its acreage about 4 miles southwest of Humble's new deep producer.

SOUTHEASTERN NEW MEXICO WILDCAT COMPLETIONS

Eddy County: Stanolind 1-N State, 2-20s-31e, elev. 3,476 ft., dry, TD 2,489 ft.

Texas Co. 1 Skidmore, 24-20s-31e, elev. 2,515 ft., dry, TD 2,963 ft.

CALENDAR

December

Interstate Oil Compact Commission, quarterly meeting, Jackson, Miss., December 15-16.

April 1945

I.P.A.A., midyear directors meeting. New Orleans, La., April 9, 10 and 11.

October 1945

I.P.A.A., annual membership meeting. convention city to be selected later. October 15, 16 and 17.

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PERSONALS

First Task Was to Set Up Producing Organization

E. R. TURNER, recently made first vice president of the Pan American companies, joined the group in 1935, when he went to Houston as general manager of Pan American Production Co. and Pan American Pipe Line Co. His first job was to set up a producing organization for the former company. He was made a vice president of both in 1939, and upon formation of Pan American Gas Co. in 1941 was named vice president of that unit also.

Born in Madisonville, Tex., Turner at 17 went to Houston, where he worked first in a bank and then for a life insurance company. His oil career began in 1914, when he joined The Texas Co., serving in various departments until 1929, when he joined Continental Oil Co. at Ponca City, Okla., as assistant to the vice president in charge of production, pipe lines, gas and gasoline, and exploration. He held this post until he entered Pan American service.

Turner was a captain of field artillery in World War I, serving overseas 13 months. Active in civic affairs, he is a member of the board and chairman of the budget committee of the Harris County War Chest and Houston Community Chest and chairman of the civilian war services division of the Office of Civilian Defense. He is a director of the Texas and Louisiana divisions of Mid-Continent Oil and Gas Association. A son, Edd, Jr., is overseas as a lieutenant of combat engineers.

R. W. Gallagher, chairman of Standard Oil Co. (New Jersey), headed a group of executives who visited the Permian basin region of West Texas and New Mexico last week. The party included **Eugene Holman,** president; **L. F. McCollum,** in charge of all producing subsidiaries, and **John W. Brice,** vice president Carter Oil Co., all of New York; **Harry C. Wiess,** president Humble Oil & Refining Co.; **David Frame,** director, and **Morgan J. Davis,** chief geologist of Humble, all of Houston. Following a conference with division heads in Midland, Tex., the group left for Corpus Christi to visit Humble division offices there.

Charles R. Hrdlicka, formerly in the legal department of Stanolind Oil & Gas Co., Tulsa, has entered private practice in Houston.

W. L. Connely, chairman Sinclair Prairie Oil Co., and **F. H. Rhees,** division superintendent of production in Kentucky, West Virginia and Ohio for Sinclair Prairie, and holding a similar post in Sinclair Wyoming Oil Co. in Wyoming, Illinois, Indiana and Michigan, have been touring the Illinois basin district, inspecting company properties.

S. K. CLARK

S. K. Clark, formerly assistant chief geologist for Continental Oil Co., has been made chairman of the company's exploration committee. He succeeds **R. E. Collom,** who will devote full time to his duties as vice president in charge of California operations. Following his graduation from University of Nebraska with a B.S. in civil engineering, he served as a pilot in World War I. From 1919 until 1924 Clark was associated with several oil companies in Oklahoma and Kansas, joining Continental in 1924 as a geologist. He was made assistant chief geologist in 1932.

Sam Thompson is president of Petroleum Accountants Society, recently organized in Dallas. **W. F. Pope,** Sun Oil Co., is vice president; **J. H. Jukes,** Great State Oil Corp., secretary; **John Hall,** Placid Oil Co., treasurer. The society will hold round-table discussions of tax problems peculiar to the oil business.

R. M. RIGGINS

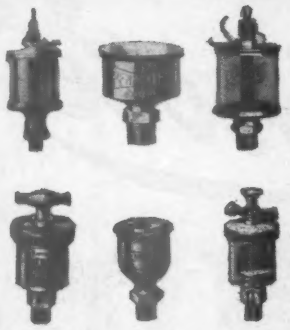
Col. Russell M. Riggins, recently released from active military duty after serving 2 years in the ordnance department, Washington, resigned last week as treasurer of Phillips Petroleum Co. to engage in business as an independent operator. Colonel Riggins joined Phillips as comptroller in 1930 and was made treasurer in 1938. He entered the Army in 1942. **B. F. Stradley,** secretary and acting treasurer, has been made treasurer and will continue to fill the office of secretary.

W. T. Rogers, expert in personnel and safety work, has been appointed chairman of the accident prevention committee of American Gas Association.

V. C. Boston and **L. W. Wiedy,** of Tropical Oil Co., from Colombia, were among foreign guests at the regular dinner meeting of the Los Angeles chapter of Nomads, held in the Mayfair Hotel November 8. Other foreign guests were **C. E. Davis,** Arabian American Oil Co., from Saudi, Arabia; **E. L. M. Trafford,** Trinidad Leaseholds, from Trinidad; **G. N. Akin** and **H. C. Keck,** Petroleum Development Co., from Qatar; **H. C. Creath,** The Texas Co., from Venezuela; **R. L. Babcock,** Colombian Petroleum Co., from Colombia; **Art Eadie,** Richmond Petroleum Co. of Colombia, from Colombia; **F. G. West,** Caribbean Petroleum Co., from Venezuela.

Joe A. Huitt, superintendent at Drumright, Okla., for Deep Rock Oil Corp., was reelected president of the Drumright chapter, division of production, American Petroleum Institute, at its annual meeting last week. **J. H. Fields,** engineer for Gulf Oil Corp. and formerly secretary-treasurer, was named first vice president. **Guy Furman,** with Eureka Tool Co., is second vice president, and **D. J. Preston,** Continental Supply Co., secretary-treasurer.

PENBERTHY
LUBRICATING
DEVICES



Glass body oilers, sight feed lubricators. Plain oil and grease cups, spring compression and screw plunger grease cups, engine lubricators . . . these are among the Penberthy lubricating devices that are so widely used in the oil industry because they have always been dependable under the most severe conditions.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

MARKET QUOTATIONS

Prices as of November 21, 1944

(This service is abbreviated because most refinery products are selling at the Government's price ceilings. Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gallon).

REFINERY GASOLINE

Octane (A.S.T.M.)	76†	70-74
Mid-Continent*	6.75	5.875
Gulf Coast	6.75	5.825
Northeast Coast		9.075
California		6.50-7.00

*Basic Oklahoma Group 3. †1939 C.F.R (research method).

NATURAL GASOLINE

Grades:	26-70	18-35
Oklahoma (Group 3)	4.750	5.700
North Texas (Dist. 1 Del.)	4.500	5.400
North Texas (f.o.b. plant)	4.375	5.250
North Louisiana (Dist. 1 Del.)	5.160	6.060
North Louisiana (f.o.b. plant)	4.375	5.250
California	4.875	5.500

CRUDE-OIL PRICES

Representative posted schedules per bbl.	
East Texas	$1.25
Conroe	1.43
Tepetate, Louisiana	1.19
Illinois basin	1.37
Pecos County, Texas	.85
Bradford, Pennsylvania	3.00
Van, Van Zandt County, Texas	1.00

Note: Exclusive of subsidy.

A.P.I. REFINERY REPORT

Week ended November 11, 1944
(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks: Gasoline	Stocks: Residual	Stocks: Gas oil
East Coast	713	12,537	10,946	15,024
Appalachian	133	3,723	485	713
Ill., Ind., Ky.	794	16,026	3,962	7,113
Okla., Kan., Mo.	335	6,929	1,691	2,476
Inland Texas	225	2,570	609	423
Tex. Gulf Coast	1,149	14,186	8,658	7,696
La. Gulf Coast	258	4,061	1,227	2,259
No. La. & Ark.	81	2,595	314	650
Rocky Mt.	112	1,601	657	408
California	850	13,863	35,450	11,547
Total 11-11-44	4,650	78,091	63,999	48,259
Total 11- 4-44	4,570	78,409	63,444	48,477
Total 11-13-43	4,154	68,344	62,409	45,296

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended—	Bbl. of crude*
November 11, 1944	222,467,000
November 4, 1944	222,894,000
November 13, 1943	238,404,000

*Excludes unrefinable California stocks.

Kansas Fields

(Continued from page 129)

Harper County: J. M. Huber 1 Fetrow, SE SW 6-32-9w, dry, TD 4,910 ft., Arbuckle 4,859 ft.

McPherson County: P. G. Reynolds et al 1 Goerug, NW SE NW 27-21-2w, dry, TD 3,527 ft., Viola 3,501 ft.

Williams & Morine 1 Henne, SW SW SW 4-17-1w, physical potential 75 bbl. per day from pay zone 2,618-36 ft., TD 2,636 ft., Mississippi lime 2,618 ft.

Reno County: Simpson Noble 1 Letkeman, NE SW SE 7-22-4w, dry, TD 4,003 ft., Arbuckle 3,973 ft.

Russell County: Maguire 1 Brundage, SW NE NW 10-12-15w, dry, TD 3,200 ft., Arbuckle 3,162 ft.

Saline County: Don Ingling et al 1 Wilson, NW NW SW 12-16-1w, dry, TD 2,662 ft., Mississippi lime 2,636 ft.

Stafford County: Cities Service 1 Jenkins "B," SW SW SE 4-25-12w, dry, TD 4,153 ft., Arbuckle 4,140 ft.

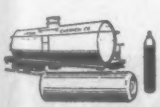
Trego County: T. H. Allen et al 1 Monroe, SW SW SW 8-11-21w, dry, TD 3,855 ft., Arbuckle 3,800 ft.

STYMIED?
TRY THESE

LIQUID Methyl Chloride BY ANSUL
LIQUID Sulfur Dioxide BY ANSUL

Problems involving Catalyst Solvents, Refining Agents, Extractants, Dewaxing Agents and Reaction Solvents...are often solved through the correct application of ANSUL SULFUR DIOXIDE or ANSUL METHYL CHLORIDE.

*REG. U.S. PAT. OFF.

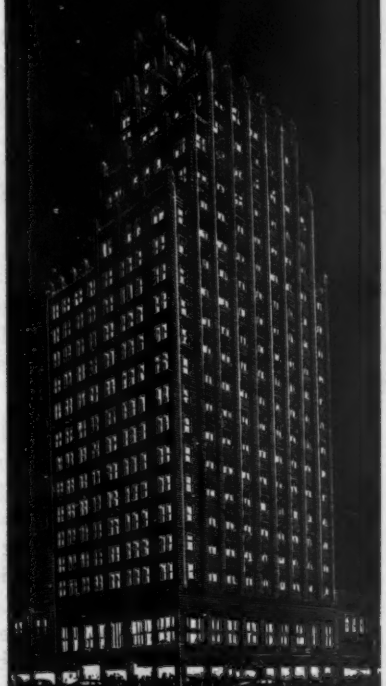


Easily handled. 99.9+% (by weight) pure. Available in cylinder, ton drums and tank cars.

ANSUL CHEMICAL CO.
MARINETTE, WISCONSIN
EASTERN OFFICE • [illegible]

HOSPITALITY
at The Blackstone

means prompt, courteous attention; comfort, convenience; superb food; and you know you are truly welcome.



Owned and managed by Texans.

The BLACKSTONE
FORT WORTH'S HOTEL OF DISTINCTION

JOE T. O'KEEFE, President
E. B. HANNA, Manager

EVERLASTING

the WEAR-RESISTING VALVE

WILL NOT STICK . . . because made of materials which will not corrode under working conditions.

WILL NOT WEDGE . . . because disc travels in a line parallel with both interior of upper bonnet and seat.

WILL NOT CLOG . . . because straight-through design permits full, unimpeded flow.

A 70-degree turn of the operating wrench completely opens or closes the Straight-Lever Type of Everlasting Valve . . . and the operation is easy, because the wrench gives ample leverage.

Add to this valuable time-saving feature the many other important advantages of the Everlasting Valve . . . its drop-tight seal, its self-grinding action at each motion, its provisions against damage to disc and seat, and its "everlasting" wearing qualities . . . and you have a valve that is literally unequalled for many services on process lines, emergency shut-offs, equipment outlets, boiler blow-off, etc.

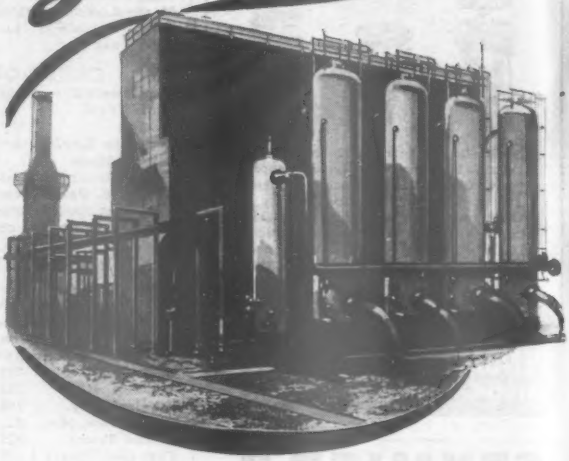
Write for Bulletin

EVERLASTING VALVE COMPANY
49 Fisk St., Jersey City 5, N. J.

Everlasting Valves
for everlasting protection

IN THIS EFFICIENT DRYER THE DESICCANT IS

Florite*



Natural gas is dehydrated by the use of Florite in this modern plant of an important company operating in the Southwest.

Made from bauxite by special processes of activation and mechanical adaptation, regenerated by heating to 350°F., Florite is superior to other granular desiccants for many and varied industrial uses. Dehydration of natural gas, represented by the illustration above, is one example. Hydrofluoric alkylation of aviation gasoline is a quite special example. Propane, butane, air, nitrogen, carbon dioxide, refrigeration compounds, and various other fluids are successfully and economically treated. Some of these uses have been established for years. New ones are developed from time to time. Correspondence is invited.

*Trade Mark Registered.

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